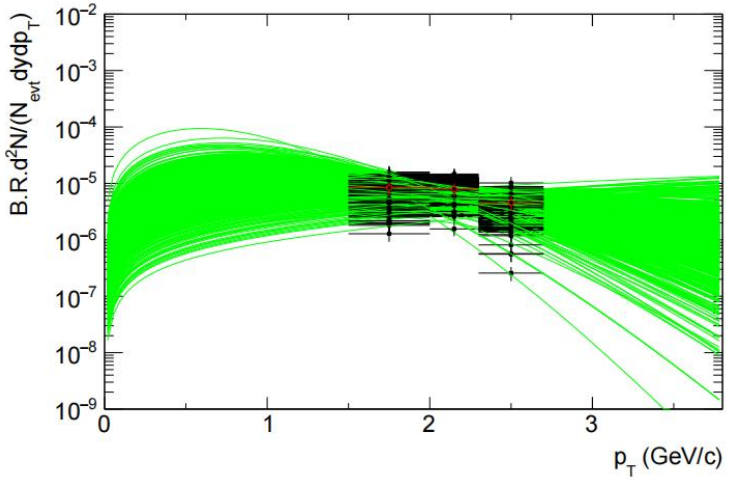
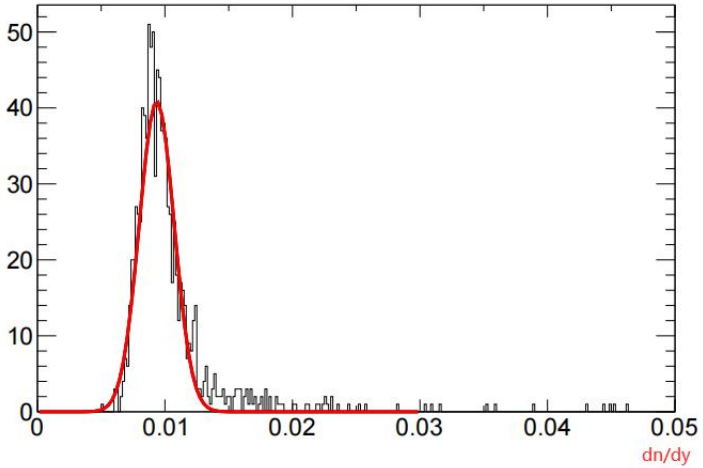
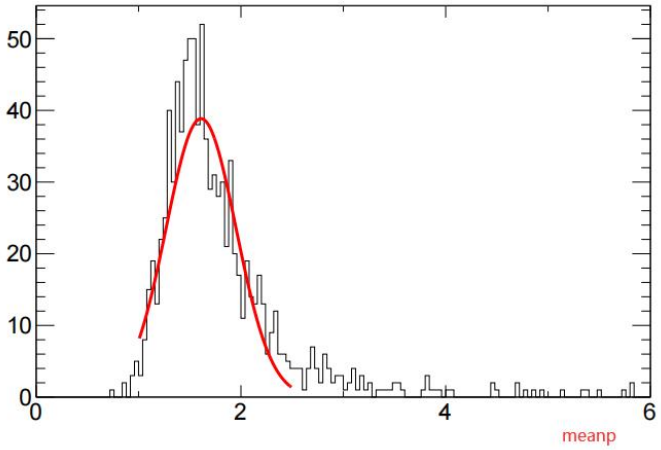
Update of signal reconstruction($^{3}_{\Lambda}H$) in Run2020 FXT Au-Au 5.2GeV

yulou

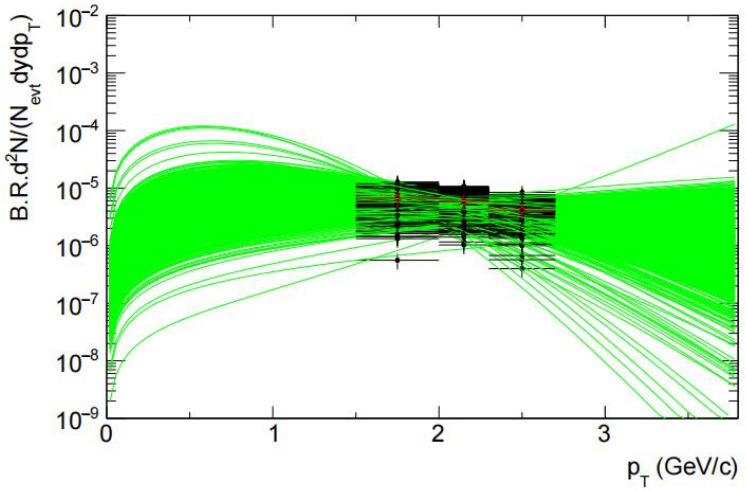
Boostrap

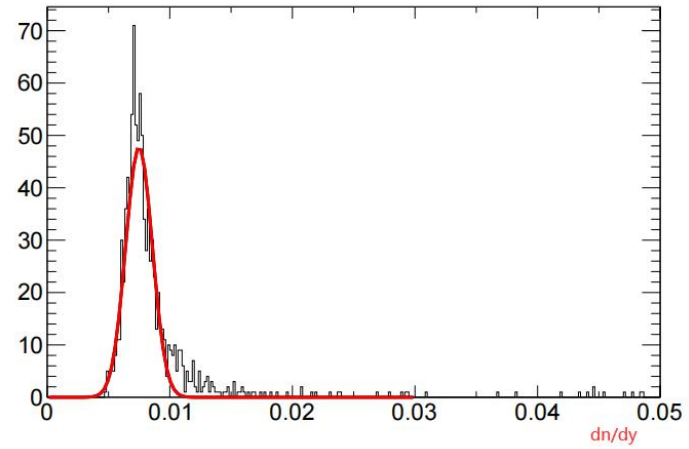


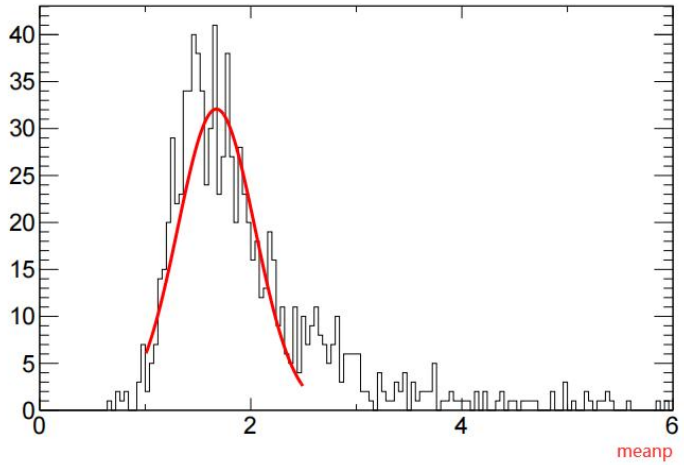




pt_pi>0.15,-0.8<y<-0.3







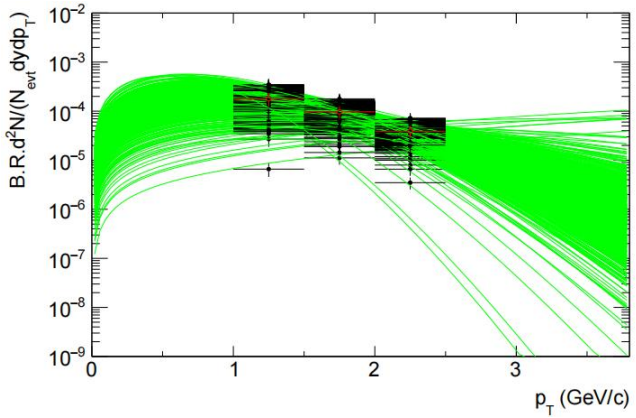
pt_pi>0.1,-0.8<y<-0.3

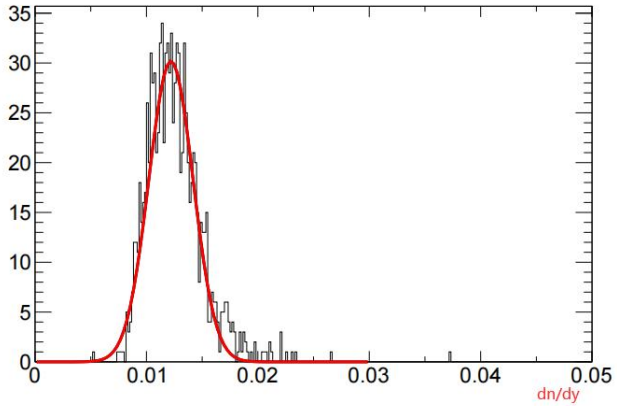
1000次，boostpoint = tRandom->Gaus(mean[i][j],error[i][j]); i:rap j:pt

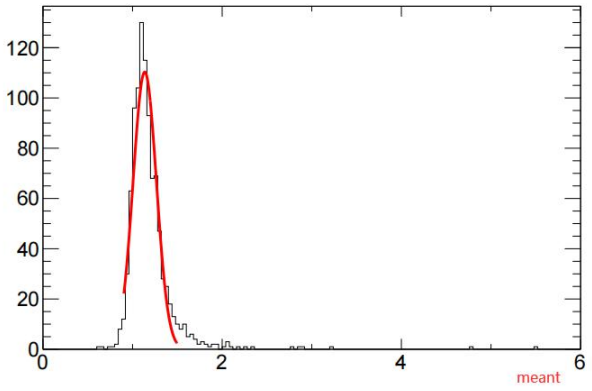
h_sgct_corr_dndydpt_boostrap[i][k]->SetBinContent(j+1,boostpoint); k:第k次

h_sgct_corr_dndydpt_boostrap[i][k]->SetBinError(j+1,boostpoint*dndy_err[i][j]/dndy_mean[i][j]);

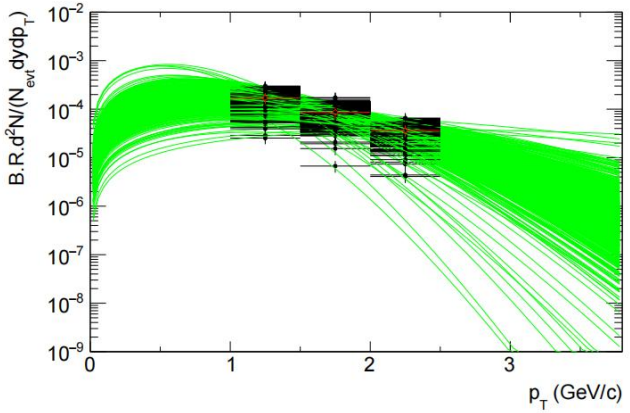
Boostrap

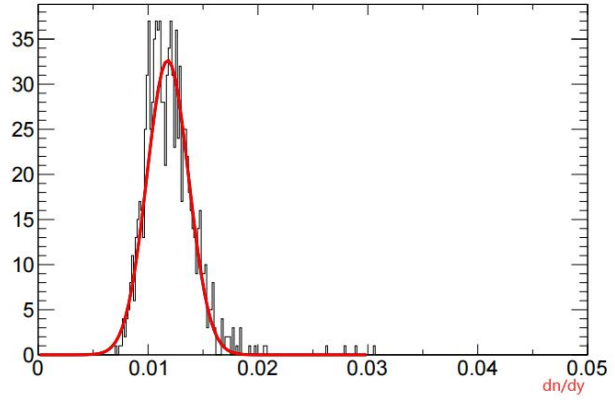


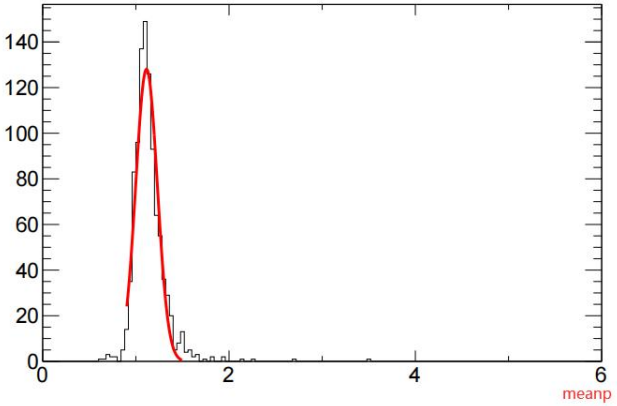




pt_pi>0.15,-1.3<y<-0.8







pt_pi>0.1,-1.3<y<-0.8

dNdy_error

•default function:boltzmann

default:pt_pi>0.15GeV/c 1.5,2.0,2.3,2.7

	100%(cen:0-10%;-1.3~-0.8)	dNdy_sys_err(cen:0-10%;-1.3~-0.8)	100%(cen:0-10%;-1.3~-0.8)	cuts
H3L Lifetime	6.05%	0.0007668	6.05%	lifetime
Tracking efficiency	12.82%	0.00029475	2.32%	nihitfit>15,20,25
		0.00097435	7.68%	pt_pi>0.06,0.1,0.15
			10.00%	single track efficiency
Topological cuts	10.13%	0.0004362	3.44%	prim_pi>3,5,7
		2.855E-05	0.23%	l>0,1,3
		0.0011723	9.24%	chi2topo<3,5
		0.00029405	2.32%	chi2ndf<2.2,3,4
Extrapolation	28.12%	0.00198715	15.67%	boltzmann boostrap
		0.00296195	23.35%	function style
Raw count extraction	7.67%	0.0006277	4.95%	rotate_background
		0.00074395	5.87%	fit_background
		dNdy_sys_err(cen:0-10%;-0.8~-0.3)	100%(cen:0-10%;-0.8~-0.3)	cuts
H3L Lifetime	4.82%	0.000436065	4.82%	
Tracking efficiency	15.61%	0.00036451	4.03%	nihitfit>15,20,25
		0.00102208	11.29%	pt_pi>0.06,0.1,0.15
			10.00%	single track efficiency
Topological cuts	10.93%	0.01%	1.38%	prim_pi>3,5,7
		5.372E-05	0.59%	l>0,1,3
		0.00096137	10.62%	chi2topo<3,5
		0.000187725	2.07%	chi2ndf<2.2,3,4
Extrapolation	21.27%	0.00136808	15.12%	boltzmann boostrap
		0.0013539	14.96%	function style
Raw count extraction	2.64%	7.6925E-05	0.85%	rotate_background
		0.000225765	2.49%	fit_background

pt_pi>0.15

default:pt_pi>0.1GeV/c 1.5,2.0,2.3,2.7

	100%(cen:0-10%;-1.3~-0.8)	dNdy_sys_err(cen:0-10%;-1.3~-0.8)	100%(cen:0-10%;-1.3~-0.8)	cuts
H3L Lifetime	6.16%	0.0007332	6.16%	
Tracking efficiency	14.02%	0.00064775	5.44%	nihitfit>15,20,25
		0.00097435	8.18%	pt_pi>0.06,0.1,0.15
			10.00%	single track efficiency
Topological cuts	10.88%	0.00042955	3.61%	prim_pi>3,5,7
		0.0000149	0.13%	l>1,3
		0.0010265	8.62%	chi2topo<3,4,5
		0.00066365	5.57%	chi2ndf<2.2,3,4
Extrapolation	28.33%	0.00189637	15.93%	boltzmann boostrap
		0.00278988	23.43%	function style
Raw count extraction	2.98%	7.965E-05	0.67%	rotate_background
		0.00034545	2.90%	fit_background
		dNdy_sys_err(cen:0-10%;-0.8~-0.3)	100%(cen:0-10%;-0.8~-0.3)	cuts
H3L Lifetime	4.93%	0.00034919	4.93%	
Tracking efficiency	18.99%	0.000199375	2.81%	nihitfit>15,20,25
		0.00102208	14.43%	pt_pi>0.06,0.1,0.15
			10.00%	single track efficiency
Topological cuts	13.26%	0.000123965	1.75%	prim_pi>3,5,7
		9.7E-07	0.01%	l>1,3
		0.00091279	12.89%	chi2topo<3,4,5
		0.00018274	2.58%	chi2ndf<2.2,3,4
Extrapolation	20.20%	0.00108771	15.36%	boltzmann boostrap
		0.000929776	13.13%	function style
Raw count extraction	0.55%	1.4855E-05	0.21%	rotate_background
		3.576E-05	0.50%	fit_background

pt_pi>0.1

Systematic uncertainty breakdown for dN/dy and <p

FXT 3.2-4.5 GeV:

dN/dy

	0-10%
Raw count extraction	2-4%
Tracking efficiency	10+(1-5)%
Topological cuts	9-17%
H3L Lifetime	3-4%
Extrapolation	9-15%

COL 7.7-27 GeV:

dN/dy

	0-10%
Raw count extraction	3-9%
Tracking efficiency	2+(2-5)%
Topological cuts	6-14%
H3L Lifetime	7-8%
Extrapolation	~~12-20%~~

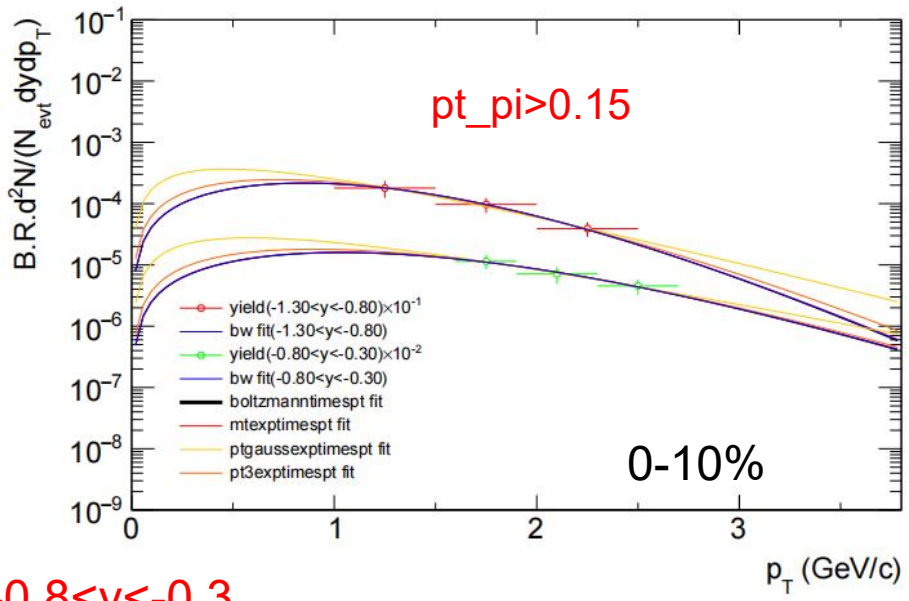
Summary

- calculate the systematic error of 0-10%

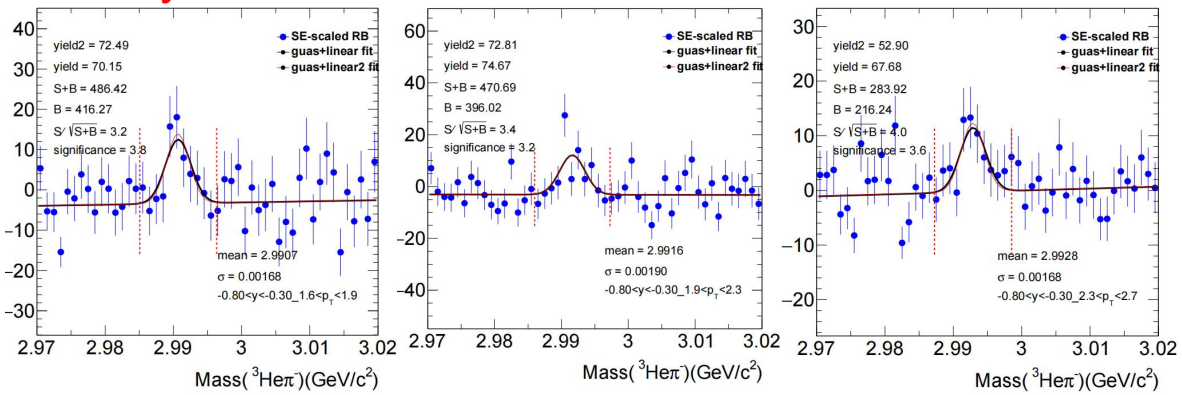
To do list

- Get systematicerror in 10-40%
- Loop new data

Differentce between different pt bins for -0.8<y<-0.3

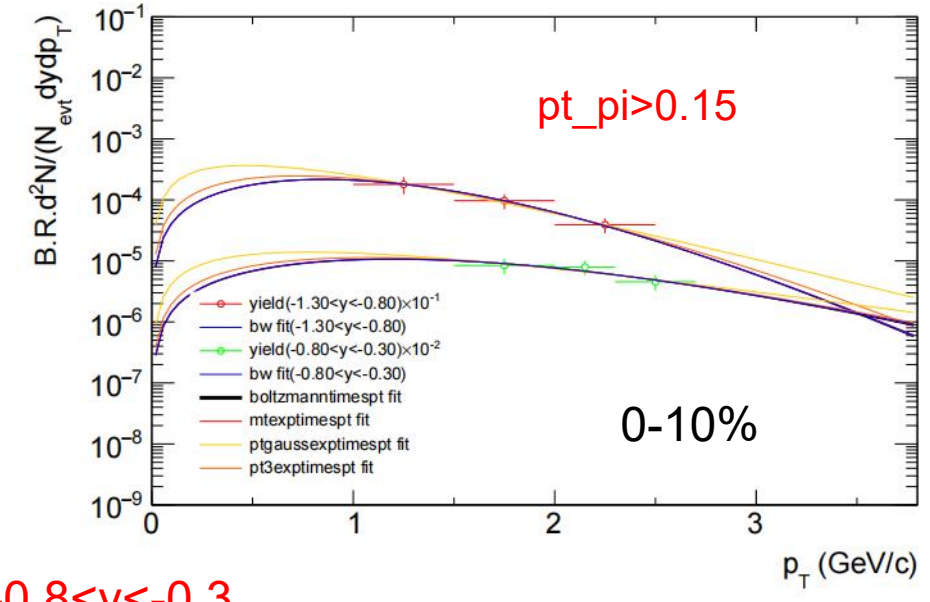


-0.8<y<-0.3

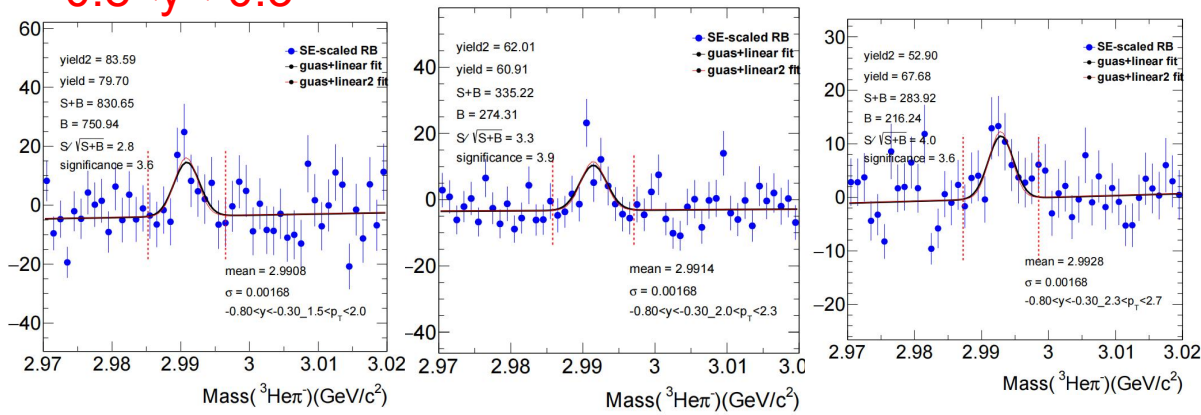


pt: 1.6-1.9; 1.9-2.3, 2.3-2.7(old)

methods	dNdy(0-10%,-0.8~-0.3)±error(scale)
data+integral (boltzmann)	0.0115077±0.00192529



-0.8<y<-0.3



pt: 1.5-2.0; 2.0-2.3, 2.3-2.7(new)

cutmode2_cut00000	0.00905093±0.00152571(16.8%)

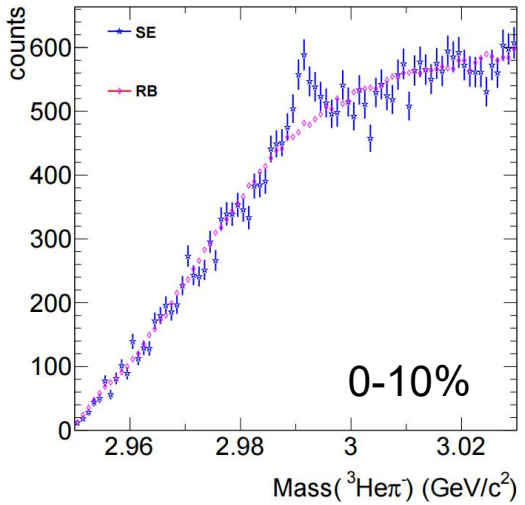
- when changing the pt bins,significance of both can reach 3, but the calculated dndy values are different~20%
- Finally the right pt bins are choosed for they make many conditions that change topological cuts can reach 3

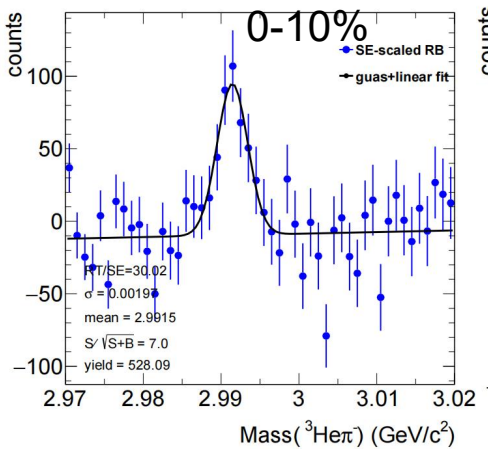
Differentce between different pt_pi cuts

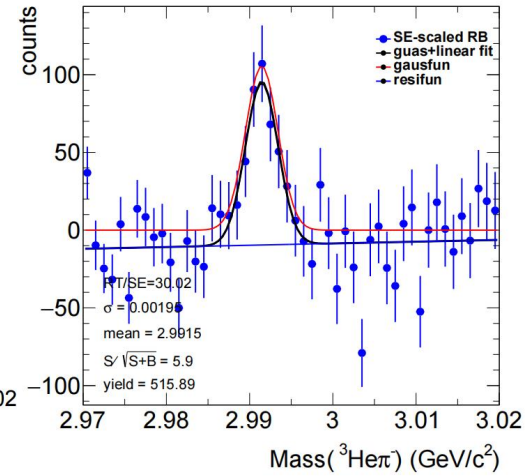
- bin by bin counting

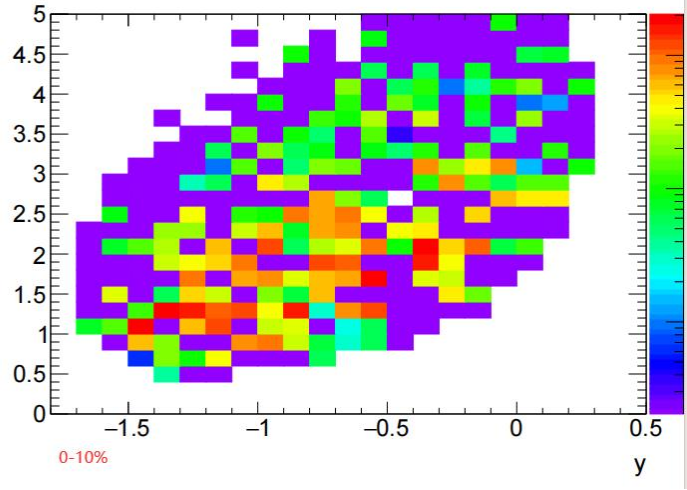
0-10%
l >1, ldl>6
chi2topo<5,
chi2ndf<2.2
chi2prim_pi>5
chi2prim_he>0

pt_pi>0.15



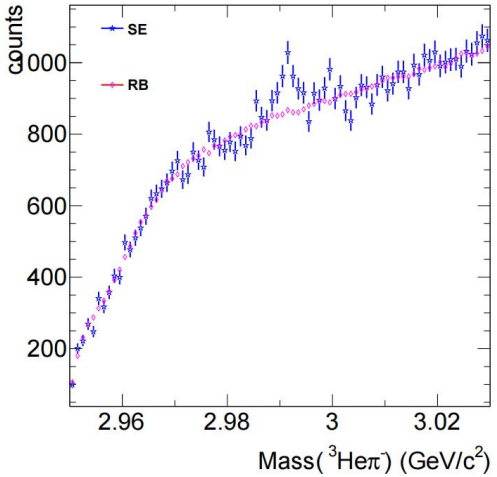


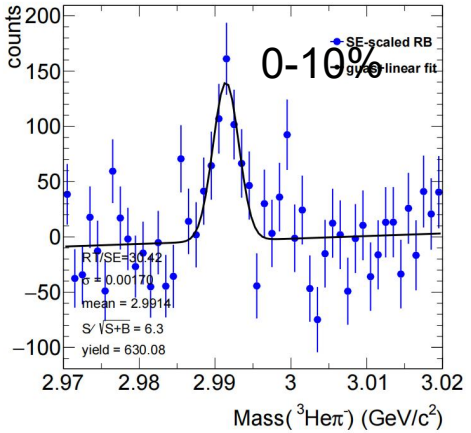


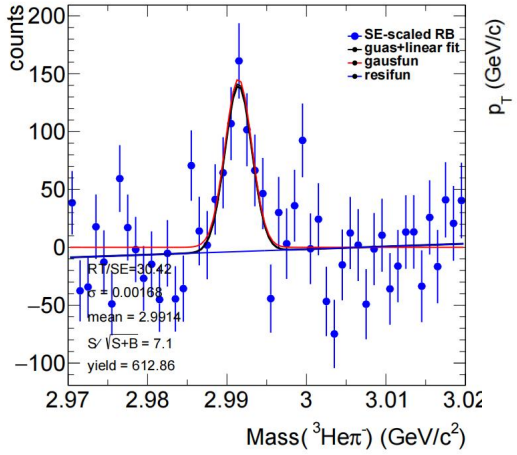


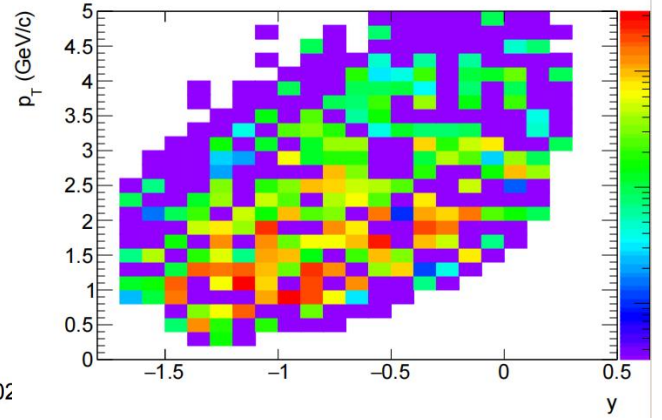
0-10%
l >1, ldl>6
chi2topo<5,
chi2ndf<2.2
chi2prim_pi>5
chi2prim_he>0

pt_pi>0.1





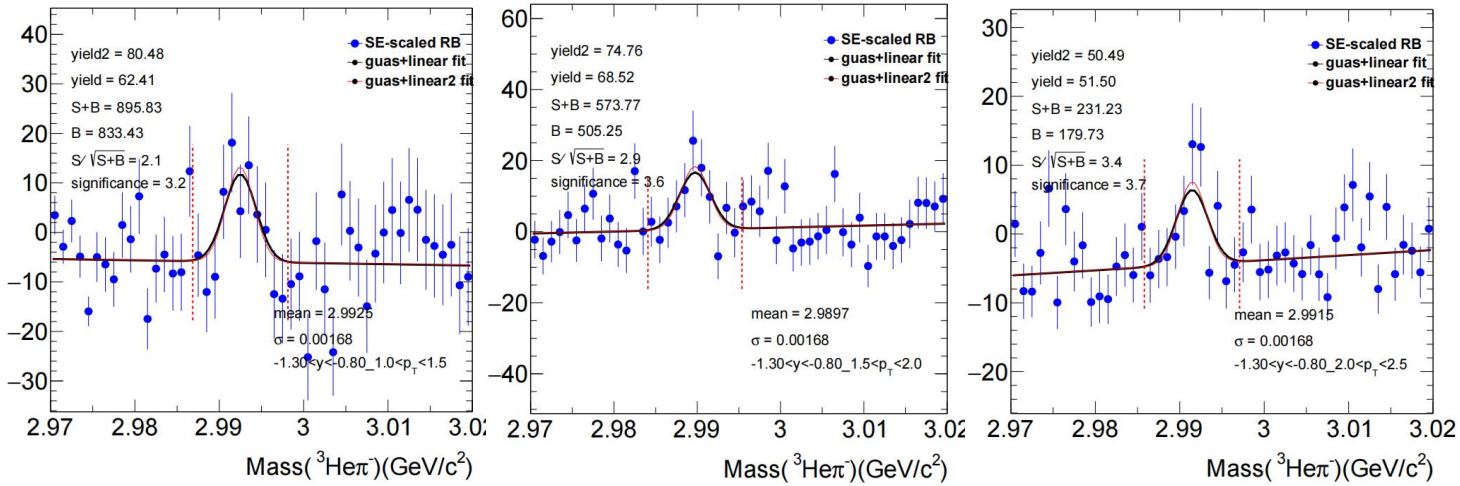


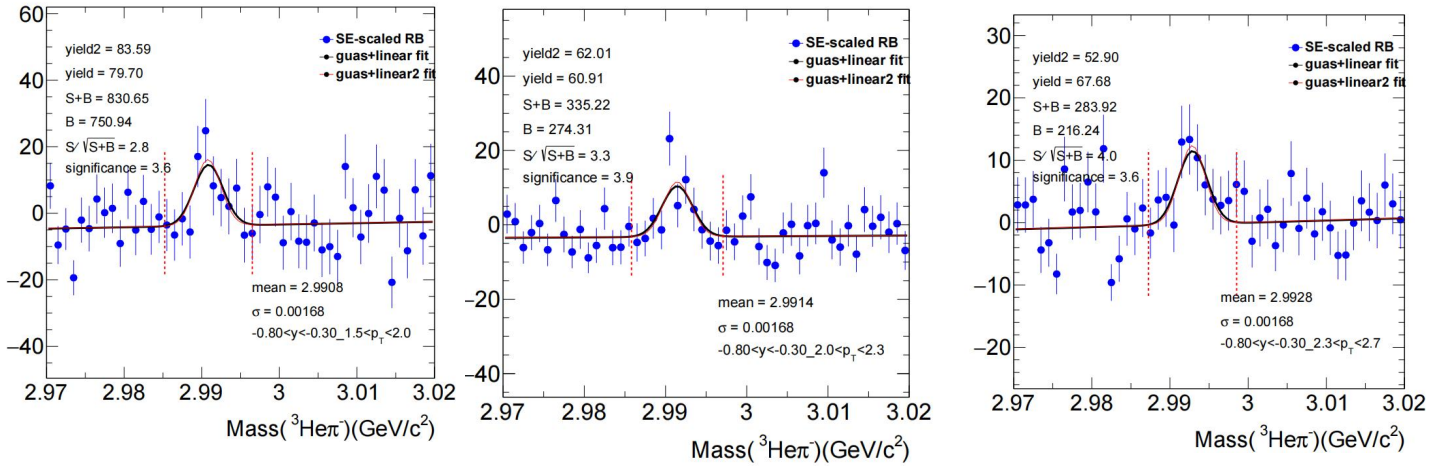


Signal with different pt and y ranges

- Cen:0-10%. pt_pi>0.15
- the mass window in each y_pt bin :fitmean-3*fitsigma<particlemass<fitmean+3*fitsigma(bin by bin counting)
- fit function:gaus+line

-1.3<y<-0.8





-0.8<y<-0.3

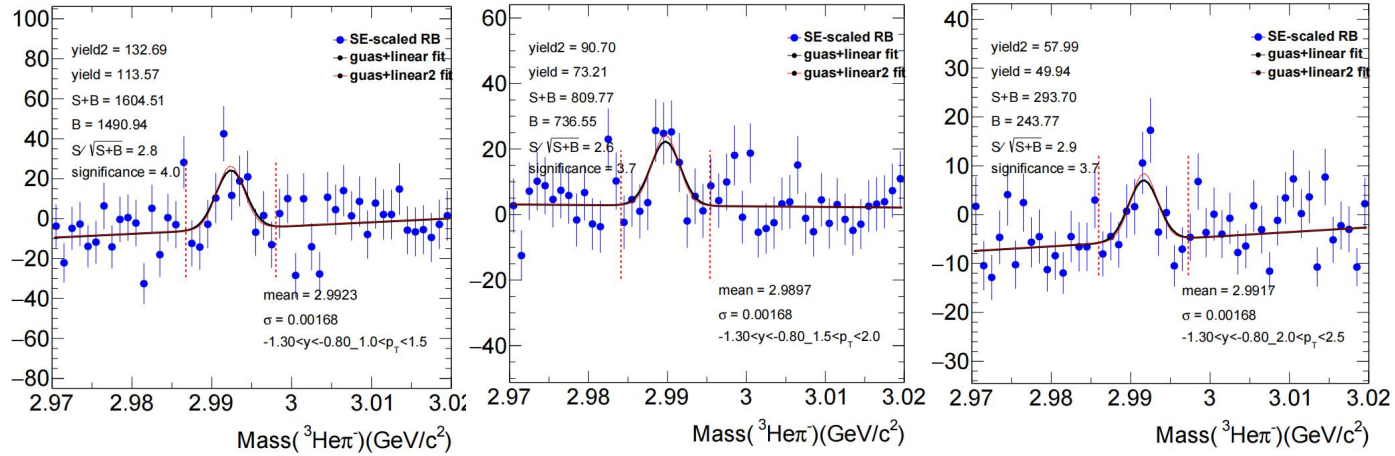
- integral method(red line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma range(guided by 0-40%) (sigma-0.0002,sigma+0.0002)

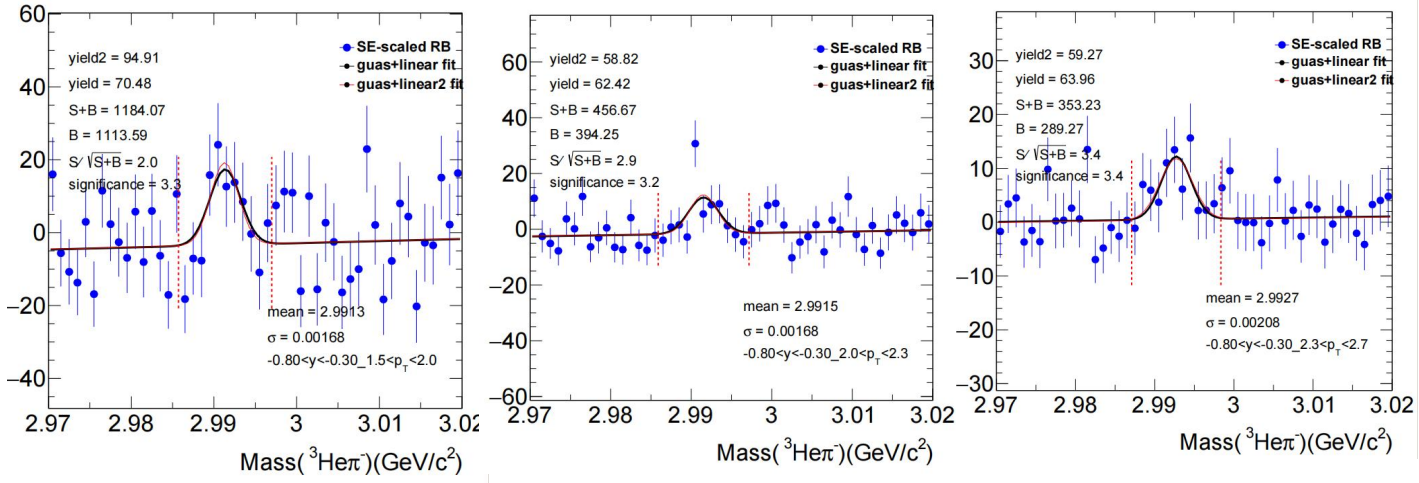
- bin by bin counting(black line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma(guided by 0-40%)

Signal with different pt and y ranges

- Cen:0-10%. pt_pi>0.1
- the mass window in each y_pt bin :fitmean-3*fitsigma<particlemass<fitmean+3*fitsigma(bin by bin counting)
- fit function:gaus+line

-1.3<y<-0.8



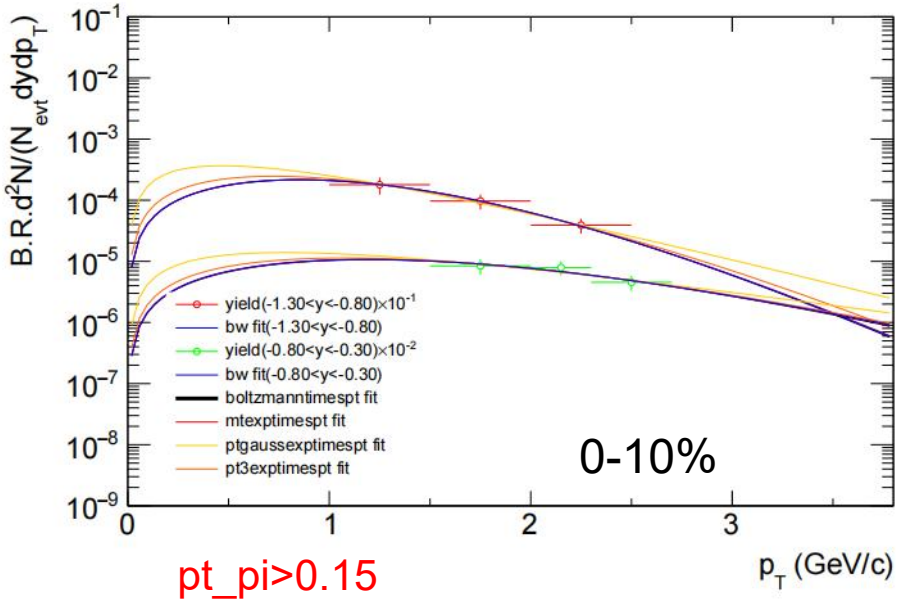


-0.8<y<-0.3

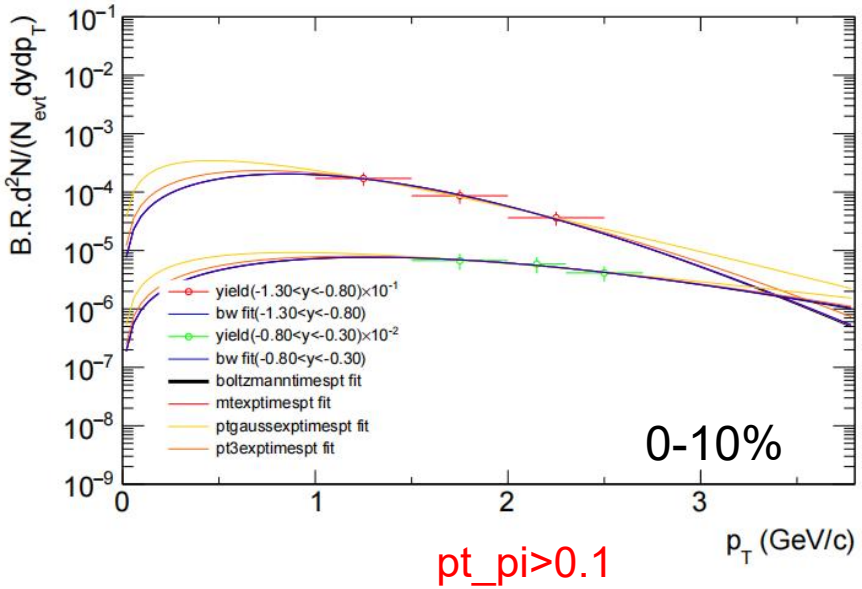
- integral method(red line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma range(guided by 0-40%) (sigma-0.0002,sigma+0.0002)

- bin by bin counting(black line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma(guided by 0-40%)

P_T spectra(Differentce between different pt_pi cuts)

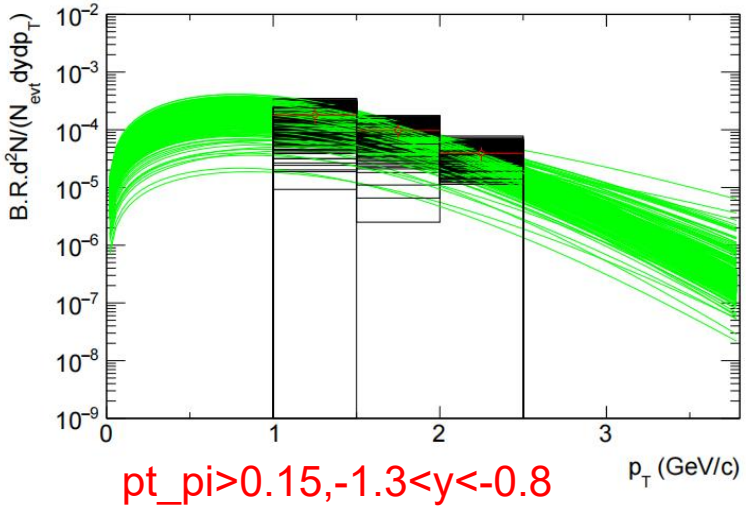


pt_pi>0.15

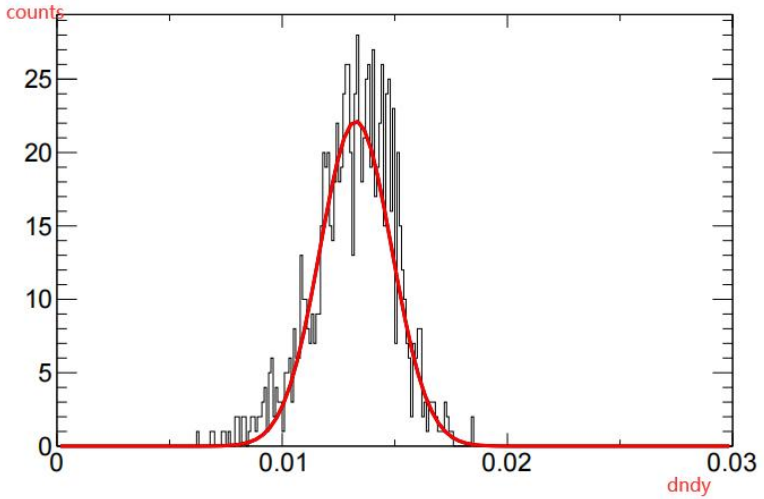


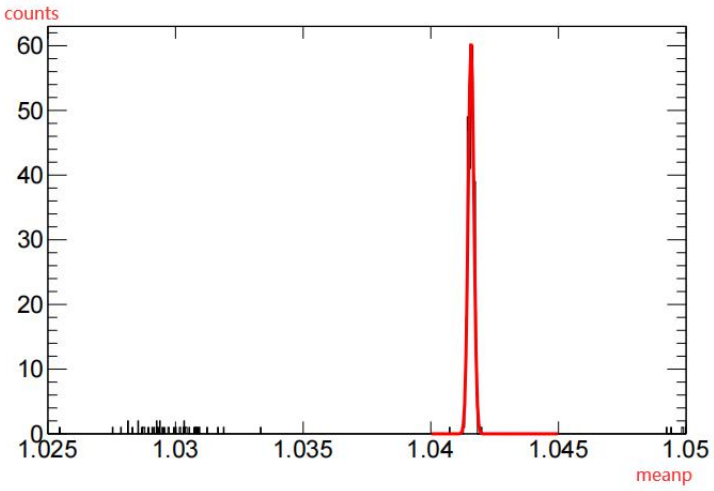
pt_pi>0.1

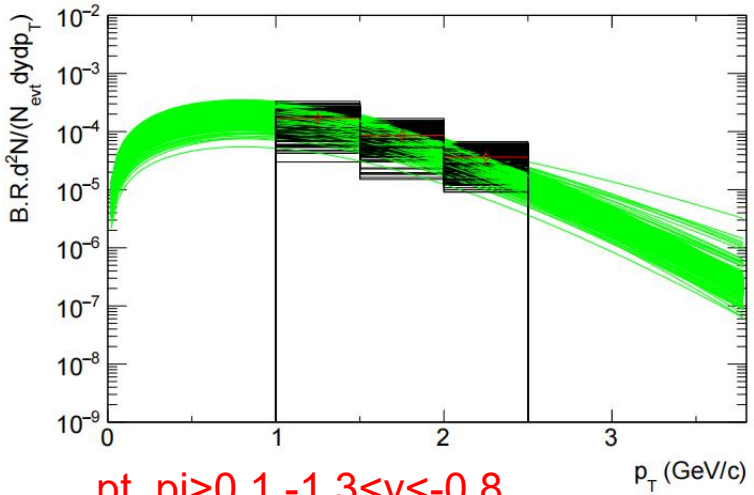
Boostrap



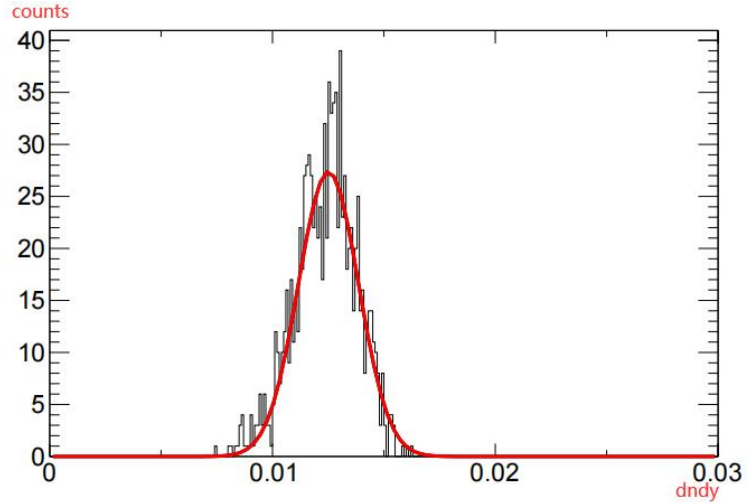
pt_pi>0.15,-1.3<y<-0.8

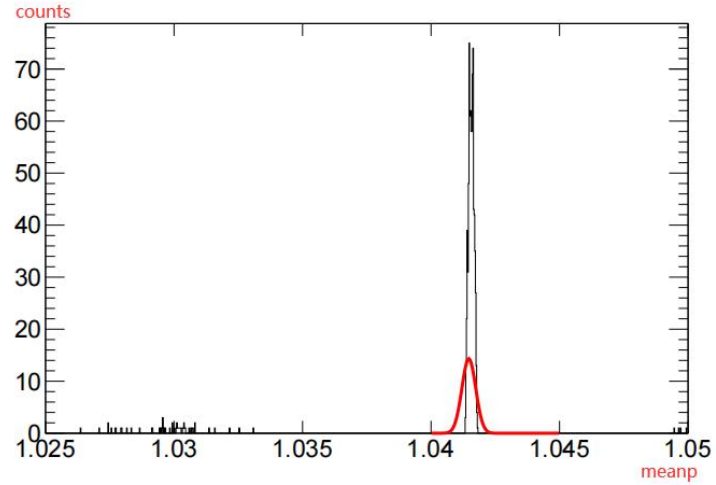






pt_pi>0.1,-1.3<y<-0.8

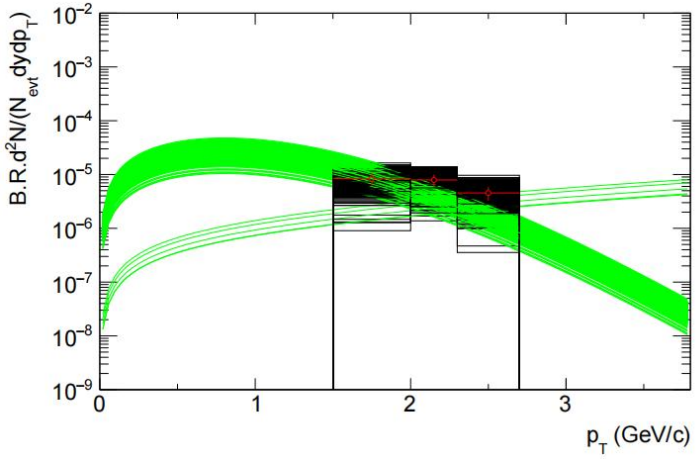


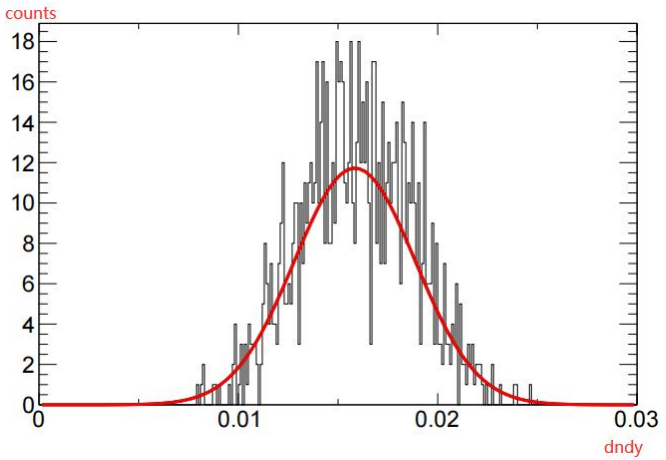


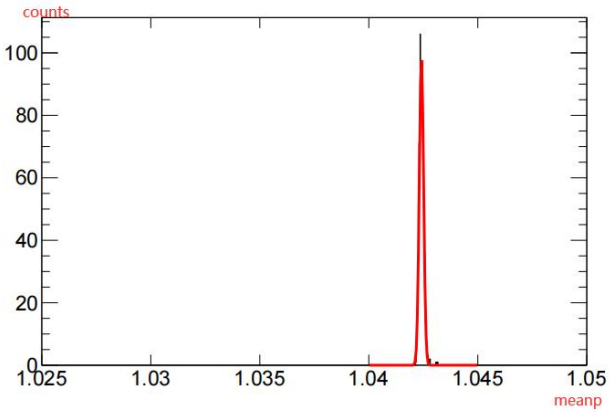
1000次，boostpoint = tRandom->Gaus(mean[i][j],error[i][j]); i:rap j:pt

h_sgct_corr_dndydpt_boostrap[i][k]->SetBinContent(j+1,boostpoint); k:第k次

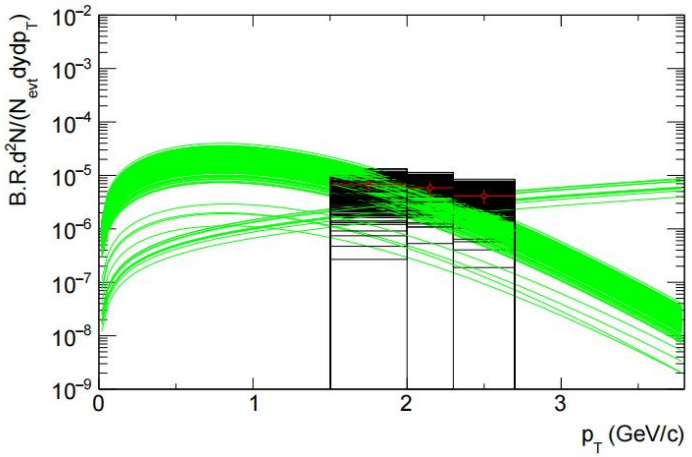
Boostrap

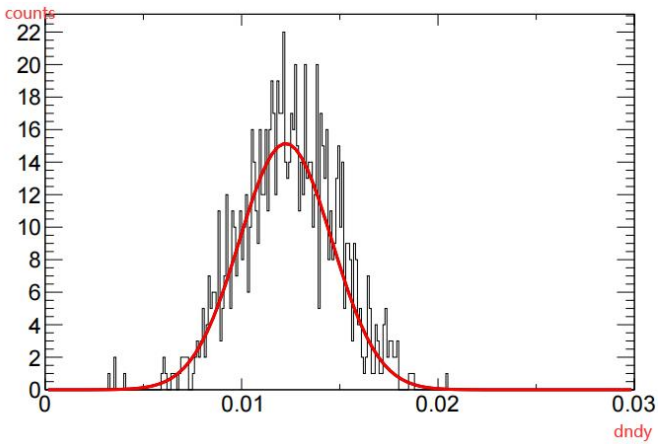


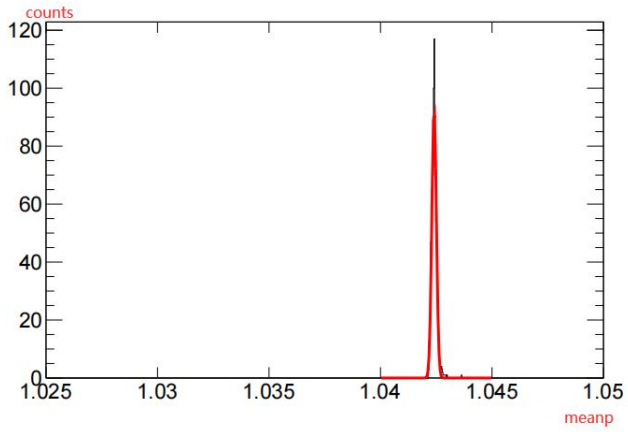




pt_pi>0.15,-0.8<y<-0.3







pt_pi>0.1,-0.8<y<-0.3

dNdy

- **default function:boltzmann**
- **dNdy**
  - data+integral:data_point*pt_width(sum of data)+integral of fit
- **dNdy_error**
  - scale method:

(error of the sum of data)*(integral of fit functionfrom 0 to 10)/(integration of fit funcition in measured pt range)

default:pt_pi>0.15 1.5,2.0,2.3,2.7

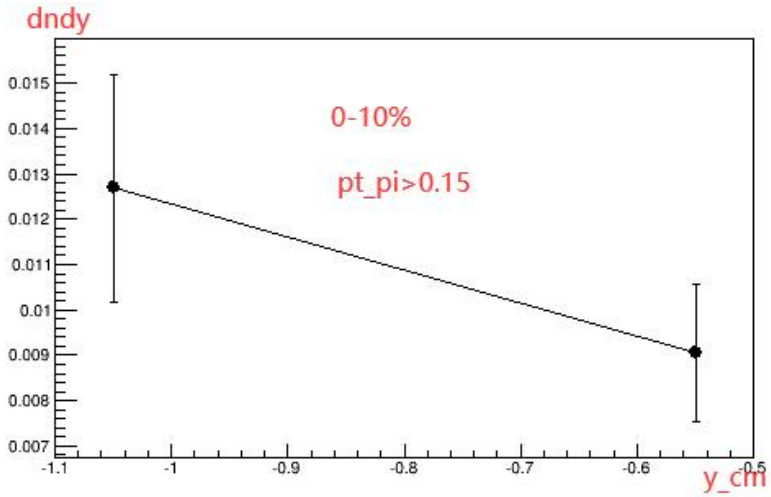
methods (boltzmann)	dNdy(0-10%,-1.3~-0.8)±error(scale)
cutmode61	0.0130853±0.00259391
cutmode62	0.013273±0.00267327
cutmode71	0.0120365±0.00238569
cutmode72	0.0135701±0.00270352
cutmode2_cut10000	0.012671±0.00254238
cutmode2_cut20000	0.0118111±0.00245858
cutmode2_cut01000	0.0127053±0.00251972
cutmode2_cut02000	0.0127406±0.00252239
cutmode2_cut00100	0.0138558±0.00300601
cutmode2_cut00200	0.0127053±0.00251972
cutmode2_cut00010	0.0122062±0.0024734
cutmode2_cut00020	0.0127943±0.0024274
cutmode2_cut00001	0.0107348±0.00197459
cutmode2_cut00002	0.0119056±0.00203043
cutmode2_cut00000	0.0126835±0.00251085
boostrap	0.0132614(mean)±0.00149689(sigma)
fit function style	0.00296195
methods (boltzmann)	dNdy(0-10%,-0.8~-0.3)±error(scale)
cutmode61(unitsfit)	0.00922064±0.00152639
cutmode62	0.00977995±0.00160076
cutmode71(lifetime)	0.00862306±0.00145157
cutmode72	0.00949519±0.00160151
cutmode2_cut10000(prim_pi)	0.00880037±0.00153586
cutmode2_cut20000	0.00880698±0.00151057
cutmode2_cut01000(l)	0.00899831±0.00151616
cutmode2_cut02000	0.00894349±0.00185624
cutmode2_cut00100(chi2topo)	0.0100123±0.00165103
cutmode2_cut00200	0.00899831±0.00151616(chi2topo<7放弃
cutmode2_cut00010(chi2ndf)	0.00916089±0.00168837
cutmode2_cut00020	0.00942638±0.00177078
cutmode2_cut00001(pt_pi)	0.00700677±0.00136966
cutmode2_cut00002	0.00708285±0.00131243
cutmode2_cut00000	0.00905093±0.00152571(16.8%)
boostrap	0.0158738(mean)±0.00284781(sigma)
fit function style	0.0013539

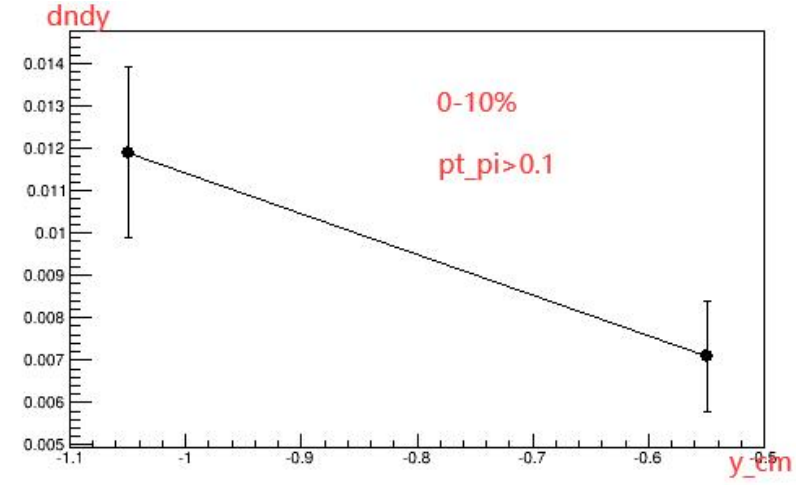
pt_pi>0.15

default:pt_pi>0.1 1.5,2.0,2.3,2.7

methods (boltzmann)	dNdy(0-10%,-1.3~-0.8)±error(scale)
cutmode61	0.0121591±0.0020712
cutmode62	0.0132011±0.00219297
cutmode71	0.0112297±0.00191154
cutmode72	0.0126961±0.00216997
cutmode2_cut10002	0.0124301±0.00208452
cutmode2_cut20002	0.011571±0.00201196
cutmode2_cut01002（放弃）	0.0119056±0.00203043
cutmode2_cut02002	0.0119205±0.00203161
cutmode2_cut00102	0.0139586±0.00242293
cutmode2_cut00202	0.0120046±0.0021356（topo7：0.0119056
cutmode2_cut00012	0.0132329±0.00213484
cutmode2_cut00022	0.0129308±0.00206256
cutmode2_cut00001	0.0107348±0.00197459
cutmode2_cut00002	0.0119056±0.00203043(17.05%)
cutmode2_cut00000	0.0126835±0.00251085
fit boostrap	0.0125127(mean)±0.0013504(sigma)
fit function style	0.00278988
methods (boltzmann)	dNdy(0-10%,-0.8~-0.3)±error(scale)
cutmode61(unitsfit)	0.00713482±0.00133526
cutmode62	0.0074816±0.00136286
cutmode71(lifetime)	0.0067589±0.00125132
cutmode72	0.00745728±0.00138321
cutmode2_cut10002(prim_pi)	0.00683492±0.00133352
cutmode2_cut20002	0.00685492±0.00131123
cutmode2_cut01002(l放弃)	0.00708285±0.00131243
cutmode2_cut02002	0.00708188±0.00131241
cutmode2_cut00102	0.00890843±0.00151016
cutmode2_cut00202	0.00739305±0.0013539(chi2topo<4)
cutmode2_cut00012(chi2ndf)	0.00692872±0.00150317
cutmode2_cut00022	0.0072942±0.00156874
cutmode2_cut00001(pt_pi)	0.00700677±0.00136966
cutmode2_cut00002	0.00708285±0.00131243(18.5%)
cutmode2_cut00000	0.00905093±0.00152571
boostrap	0.0122436(mean)±0.00235034(sigma)
fit function style	0.000929776

pt_pi>0.1





dNdy_error

•default function:boltzmann

default:pt_pi>0.15GeV/c 1.5,2.0,2.3,2.7

	dNdy_sys_err(cen:0-10%;-1.3~-0.8)	100%(cen:0-10%;-1.3~-0.8)	cuts
H3L Lifetime	0.0007668	6.05%	lifetime
Tracking efficiency	0.00029475	2.32%	nihitfit>15,20,25
	0.00097435	7.68%	pt_pi>0.06,0.1,0.15
Topological cuts	0.0004362	3.44%	prim_pi>3,5,7
	2.855E-05	0.23%	l>0,1,3
	0.0011723	9.24%	chi2topo<3,5
	0.00029405	2.32%	chi2ndf<2.2,3,4
Extrapolation	0.00149689	11.80%	boltzmann boostrap
	0.00296195	23.35%	function style
	dNdy_sys_err(cen:0-10%;-0.8~-0.3)	100%(cen:0-10%;-0.8~-0.3)	cuts
H3L Lifetime	0.000436065	4.82%	
Tracking efficiency	0.00036451	4.03%	nihitfit>15,20,25
	0.00102208	11.29%	pt_pi>0.06,0.1,0.15
Topological cuts	0.01%	1.38%	prim_pi>3,5,7
	5.372E-05	0.59%	l>0,1,3
	0.00096137	10.62%	chi2topo<3,5
	0.000187725	2.07%	chi2ndf<2.2,3,4
Extrapolation	0.00284781	31.46%	boltzmann boostrap
	0.0013539	14.96%	function style

pt_pi>0.15

default:pt_pi>0.1GeV/c 1.5,2.0,2.3,2.7

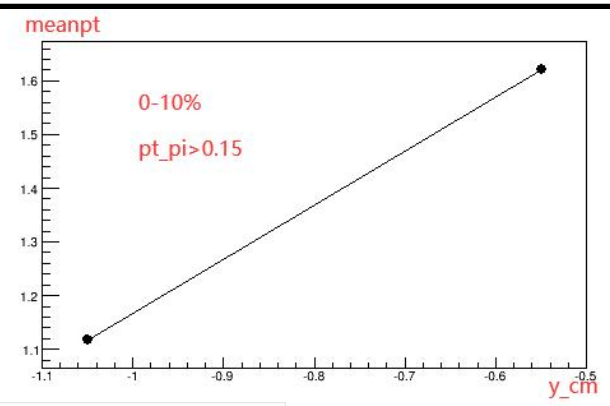
	dNdy_sys_err(cen:0-10%;-1.3~-0.8)	100%(cen:0-10%;-1.3~-0.8)	cuts
H3L Lifetime	0.0007332	6.16%	
Tracking efficiency	0.00064775	5.44%	nihitfit>15,20,25
	0.00097435	8.18%	pt_pi>0.06,0.1,0.15
Topological cuts	0.00042955	3.61%	prim_pi>3,5,7
	0.0000149	0.13%	l>1,3
	0.0010265	8.62%	chi2topo<3,4,5
	0.00066365	5.57%	chi2ndf<2.2,3,4
Extrapolation	0.0013504	11.34%	boltzmann boostrap
	0.00278988	23.43%	function style
	dNdy_sys_err(cen:0-10%;-0.8~-0.3)	100%(cen:0-10%;-0.8~-0.3)	cuts
H3L Lifetime	0.00034919	4.93%	
Tracking efficiency	0.000199375	2.81%	nihitfit>15,20,25
	0.00102208	14.43%	pt_pi>0.06,0.1,0.15
Topological cuts	0.000123965	1.75%	prim_pi>3,5,7
	9.7E-07	0.01%	l>1,3
	0.00091279	12.89%	chi2topo<3,4,5
	0.00018274	2.58%	chi2ndf<2.2,3,4
Extrapolation	0.00235034	33.18%	boltzmann boostrap
	0.000929776	13.13%	function style

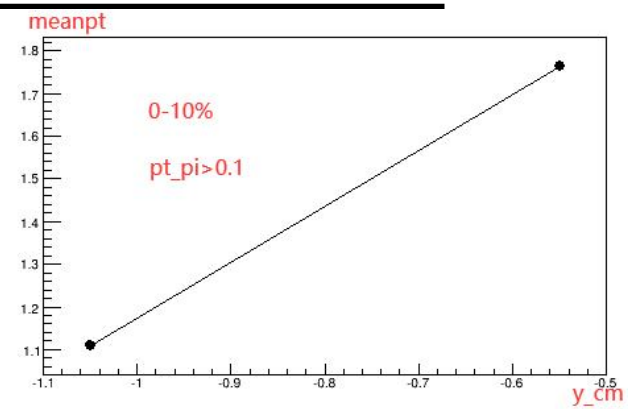
pt_pi>0.1

meanpt

$\langle p_T \rangle = \int p_T \cdot \frac{d^2N}{dp_T dy} dp_T / \int \frac{d^2N}{dp_T dy} dp_T$ (from fitting function, $0<p_T<10$ GeV/c)

- **default function:boltzmann**
- the function of numerator use the same parameters as function of denominator





default:pt_pi>0.15 1.5,2.0,2.3,2.7

methods (boltzmann)	meanpt(0-10%,-1.3~-0.8)±error(scale)
cutmode61(mnitsfit)	1.11105
cutmode62	1.11151
cutmode71(lifetime)	1.1166
cutmode72	1.10849
cutmode2_cut10000(prim_pi)	1.11654
cutmode2_cut20000	1.13595
cutmode2_cut01000(l)	1.11484
cutmode2_cut02000	1.11352
cutmode2_cut00100(chi2topo)	1.09656
cutmode2_cut00200	1.11484(放弃)
cutmode2_cut00010(chi2ndf)	1.12901
cutmode2_cut00020	1.14451
cutmode2_cut00001(pt_pi)	1.14848
cutmode2_cut00002	1.10791
cutmode2_cut00000	1.11627
boostrap	1.04158±0.000110632
fit function style	0.089821
methods (boltzmann)	meanpt(0-10%,-0.8~-0.3)±error(scale)
cutmode61(mnitsfit)	1.67511
cutmode62	1.64629
cutmode71(lifetime)	1.63235
cutmode72	1.61843
cutmode2_cut10000(prim_pi)	1.58987
cutmode2_cut20000	1.59495
cutmode2_cut01000(l)	1.62951
cutmode2_cut02000	1.80724
cutmode2_cut00100(chi2topo)	1.9478
cutmode2_cut00200	1.62951（放弃）
cutmode2_cut00010(chi2ndf)	1.41268
cutmode2_cut00020	1.40856
cutmode2_cut00001(pt_pi)	1.64594
cutmode2_cut00002	1.76474
cutmode2_cut00000	1.62181
boostrap	1.04242±9.81306e-05
fit function style	0.03418

pt_pi>0.15

default:pt_pi>0.1 1.5,2.0,2.3,2.7

methods (boltzmann)	meanpt(0-10%,-1.3~-0.8)±error(scale)
cutmode61(mnitsfit)	1.10995
cutmode62	1.08917
cutmode71(lifetime)	1.11189
cutmode72	1.10367
cutmode2_cut10002(prim_pi)	1.09561
cutmode2_cut20002	1.11118
cutmode2_cut01002(l放弃)	1.10791（放弃）
cutmode2_cut02002	1.10722
cutmode2_cut00102(chi2topo)	1.09577
cutmode2_cut00202	1.10473
cutmode2_cut00012(chi2ndf)	1.06648
cutmode2_cut00022	1.09528
cutmode2_cut00001(pt_pi)	1.14848
cutmode2_cut00002	1.10791
cutmode2_cut00000	1.11627
fit boostrap	1.04147±0.000268025
fit function style	0.089618
methods (boltzmann)	meanpt(0-10%,-0.8~-0.3)±error(scale)
cutmode61(mnitsfit)	1.73842
cutmode62	1.86699
cutmode71(lifetime)	1.7734
cutmode72	1.75594
cutmode2_cut10002(prim_pi)	1.70088
cutmode2_cut20002	1.73716
cutmode2_cut01002(l放弃)	1.76474（放弃）
cutmode2_cut02002	1.76486
cutmode2_cut00102(chi2topo)	1.75297
cutmode2_cut00202	1.73667
cutmode2_cut00012(chi2ndf)	1.52756
cutmode2_cut00022	1.47999
cutmode2_cut00001(pt_pi)	1.64594
cutmode2_cut00002	1.76474
cutmode2_cut00000	1.62181
boostrap	1.0424±0.00010121
fit function style	0.02237

pt_pi>0.1

default:pt_pi>0.15 1.5,2.0,2.3,2.7

methods	meanpt(0-10%,-1.3~-0.8)
meantpt (boltzmann)	1.11627
meantpt (mtexptrap)	1.11533
meantpt (ptgaussexp)	0.936628
meantpt (pt3exptrap)	1.05859
methods	meanpt(0-10%,-0.8~-0.3)
meantpt (boltzmann)	1.62181
meantpt (mtexptrap)	1.62538
meantpt (ptgaussexp)	1.55702
meantpt (pt3exptrap)	1.58303

default:pt_pi>0.1 1.5,2.0,2.3,2.7

methods	meanpt(0-10%,-1.3~-0.8)
meantpt (boltzmann)	1.10791
meantpt (mtexptrap)	1.10704
meantpt (ptgaussexp)	0.928674
meantpt (pt3exptrap)	1.05048
methods	meanpt(0-10%,-0.8~-0.3)
meantpt (boltzmann)	1.76474
meantpt (mtexptrap)	1.7734
meantpt (ptgaussexp)	1.78216
meantpt (pt3exptrap)	1.73742

meanpt_err

•default function:boltzmann

default:pt_pi>0.15GeV/c 1.5,2.0,2.3,2.7

	meanpt_sys_err(cen:0-10%;-1.3~-0.8)	100%(cen:0-10%;-1.8~-0.8)	cuts
H3L Lifetime	0.004055	0.36%	lifetime
Tracking efficiency	0.00261	0.23%	nihitfit>15,20,25
	0.020285	1.82%	pt_pi>0.06,0.1,0.15
Topological cuts	0.00984	0.88%	prim_pi>3,5,7
	0.001375	0.12%	l>1,3
	0.01971	1.77%	chi2topo<3,5
	0.01412	1.26%	chi2ndf<2.2,3,4
Extrapolation	1.04158+0.000110632	9.99E-07	boltzmann boostrap
	0.089821	8.05%	function style
	meanpt_sys_err(cen:0-10%;-0.8~-0.3)	100%(cen:0-10%;-0.8~-0.3)	cuts
H3L Lifetime	0.00696	0.43%	
Tracking efficiency	0.02665	1.64%	nihitfit>15,20,25
	0.071465	4.41%	pt_pi>0.06,0.1,0.15
Topological cuts	0.01597	0.98%	prim_pi>3,5,7
	0.092715	5.72%	l>1,3
	0.32599	20.10%	chi2topo<3,5
	0.106625	6.57%	chi2ndf<2.2,3,4
Extrapolation	1.04242+9.81306e-05	5.56E-07	boltzmann boostrap
	0.03418	2.11%	function style

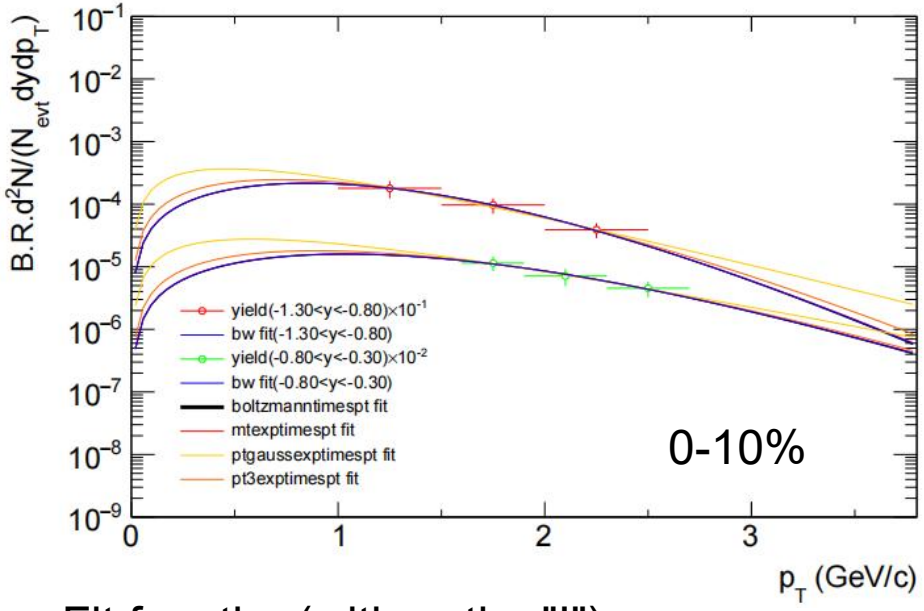
pt_pi>0.15

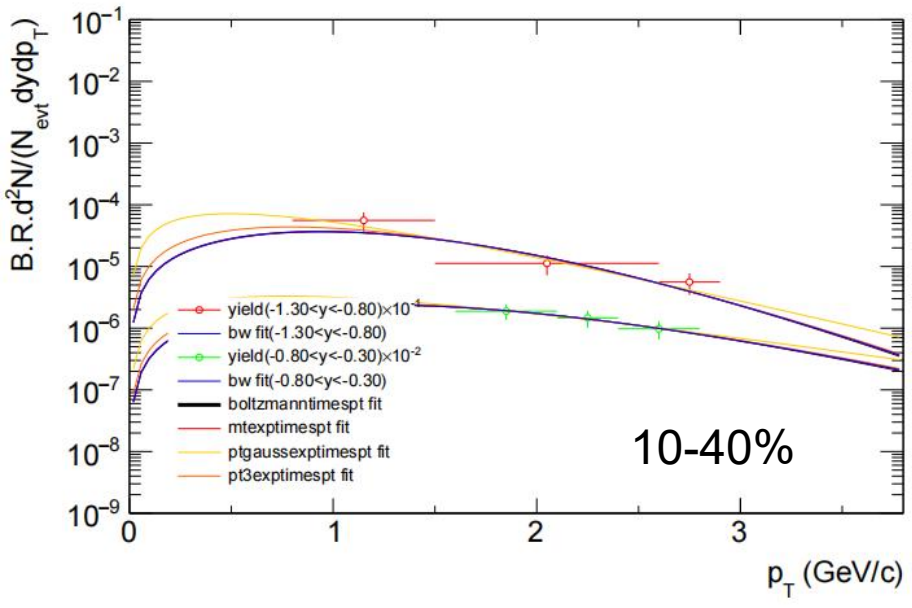
default:pt_pi>0.1GeV/c 1.5,2.0,2.3,2.7

	meanpt_sys_err(cen:0-10%;-1.3~-0.8)	100%(cen:0-10%;-1.8~-0.8)	cuts
H3L Lifetime	0.00411	0.37%	lifetime
Tracking efficiency	0.01039	0.94%	nihitfit>15,20,25
	0.020285	1.83%	pt_pi>0.06,0.1,0.15
Topological cuts	0.007785	0.70%	prim_pi>3,5,7
	0.00069	0.06%	l>1,3
	0.00607	0.55%	chi2topo<3,4,5
	0.020715	1.87%	chi2ndf<2.2,3,4
Extrapolation	0.000268025	0.02%	boltzmann boostrap
	0.089618	8.09%	function style
	meanpt_sys_err(cen:0-10%;-0.8~-0.3)	100%(cen:0-10%;-0.8~-0.3)	cuts
H3L Lifetime	0.00873	0.49%	lifetime
Tracking efficiency	0.064285	3.64%	nihitfit>15,20,25
	0.071465	4.05%	pt_pi>0.06,0.1,0.15
Topological cuts	0.03193	1.81%	prim_pi>3,5,7
	0.00012	0.01%	l>1,3
	0.014035	0.80%	chi2topo<3,4,5
	0.142375	8.07%	chi2ndf<2.2,3,4
Extrapolation	0.00010121	0.01%	boltzmann boostrap
	0.02237	1.27%	function style

pt_pi>0.1

P_T spectra





- Fit function(with option"I")
  - boltzmann: [1]*x*sqrt([2]*[2]+x*x)*exp(-sqrt([2]*[2]+x*x)/[0]) (x:pt ;para[2]:mass fixed)
  - mtexp: [1]*x*exp(-sqrt(x**2+[2]**2)/[0]) (x:pt ;para[2]:mass fixed) $(C \cdot \exp(-\frac{m_T}{T}))$, $(C \cdot m_T \exp(-\frac{m_T}{T}))$,
  - ptgaussexp: x*[1]*exp(-x/[0]) (x:pt ;para[2]:mass fixed) $(C \cdot \exp(-\frac{p_T}{\mu}))$,
  - pt3exp: x*[1]*exp(-pow(x,1.5)/[0]) (x:pt ;para[2]:mass fixed) $(C \cdot \exp(-\frac{p_T^{3/2}}{\mu}))$
  - bwexp: GetBGBWdNdptTimesPt (para[0]:mass fixed;para[3]:n fixed 1) $\int_0^R r dr m_T I_0\left(\frac{p_T \sinh\rho(r)}{T_{kin}}\right) \times K_1\left(\frac{m_T \cosh\rho(r)}{T_{kin}}\right)$

- ptgaussexp and pt3exp are higher than others especially ptgaussexp

$$\frac{d^2N}{dp_T dy} = \frac{1}{\text{B.R.}} \times \frac{N^{\text{raw}}}{N_{\text{evt}} \Delta(p_T) \Delta(y)} \times \frac{1}{\varepsilon_{\text{TPC}} \times \varepsilon_{\text{PID}}}$$

^3_2He: 3σ~1

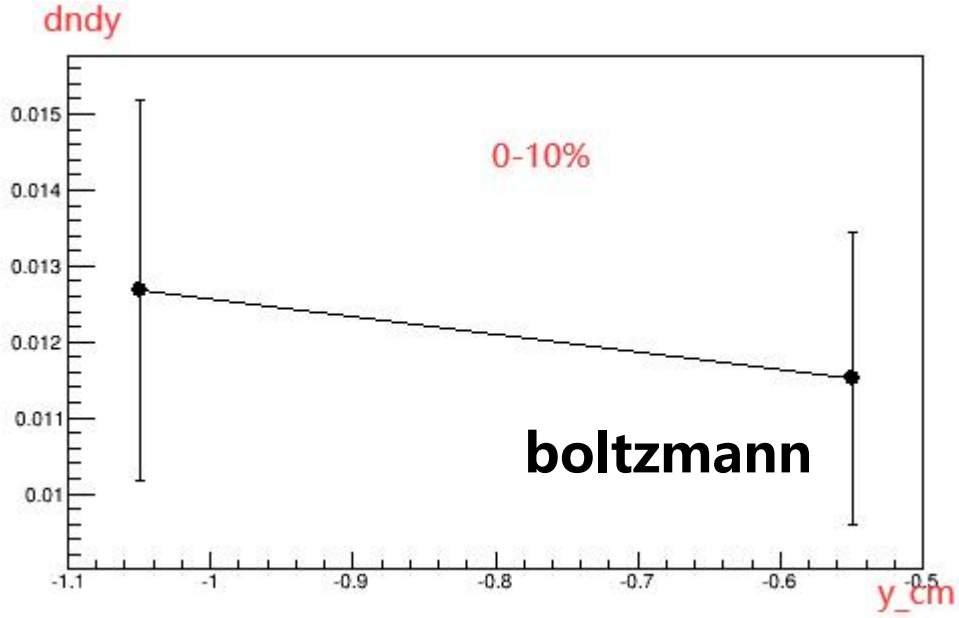
P_T spectra

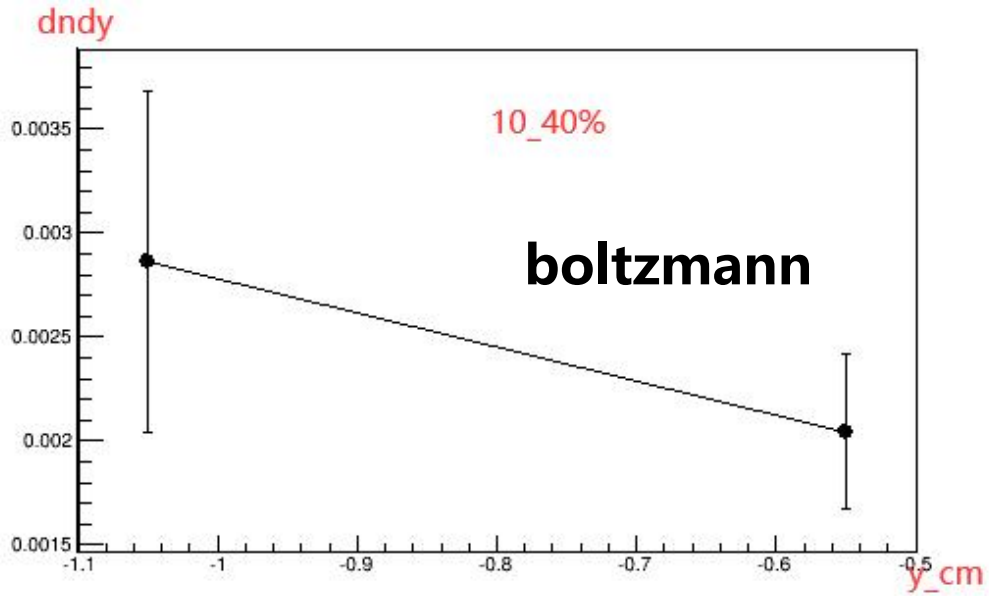
- **default function:boltzmann**
- **dNdy**
  - data+integral:data_point*pt_width(sum of data)+integral of fit
- **dNdy_error**
  - scale method:

(error of the sum of data)*(integral of fit functionfrom 0 to 10)/(integration of fit funcition in measured pt range)

- system error from fit function styles~25%

```
dndy_err_funcstyle_sys1:0.00296195
dndy_err_funcstyle_sys2:0.00298735
```



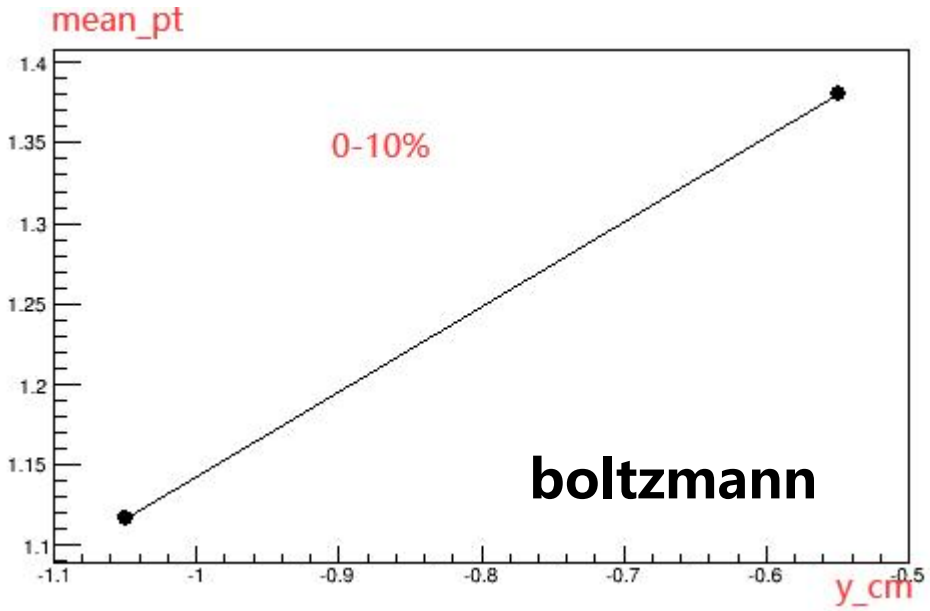


methods	dNdy(0-10%,-1.3~-0.8)±error(scale)	dNdy(10-40%,-1.8~-0.8)±error(scale)
data+integral (boltzmann)	0.0126835±0.00251085	0.00286079±0.000823171
integral (boltzmann)	0.0126755±0.00251085	0.00238693±0.000823171
scale (boltzmann)	0.0126915±0.00251085	0.00307239±0.000823171
data+integral (mtexptrap)	0.0127261±0.00251085	0.0028718±0.000823171
data+integral (bwexptrap)	0.0127065±0.00251085	0.00287498±0.000823171
data+integral (ptgaussexp)	0.0186072±0.00251085	0.0040477±0.000823171
data+integral (pt3exptrap)	0.0141621±0.00251085	0.00312603±0.000823171
methods	dNdy(0-10%,-0.8~-0.3)±error(scale)	dNdy(10-40%,-0.8~-0.3)±error(scale)
data+integral (boltzmann)	0.0115077±0.00192529	0.0020458±0.000374291
integral (boltzmann)	0.0115238±0.00192529	0.00204764±0.000374291
scale (boltzmann)	0.0114668±0.00192529	0.00204233±0.000374291
data+integral (mtexptrap)	0.0116005±0.00251085	0.00206458±0.000374291
data+integral (bwexptrap)	0.0115595±0.00251085	0.00206745±0.000374291
data+integral (ptgaussexp)	0.0174824±0.00251085	0.00272665±0.000374291
data+integral (pt3exptrap)	0.0128424±0.00251085	0.00220094±0.000374291

- **default function:boltzmann**
- using parameters from fit function in slides 2

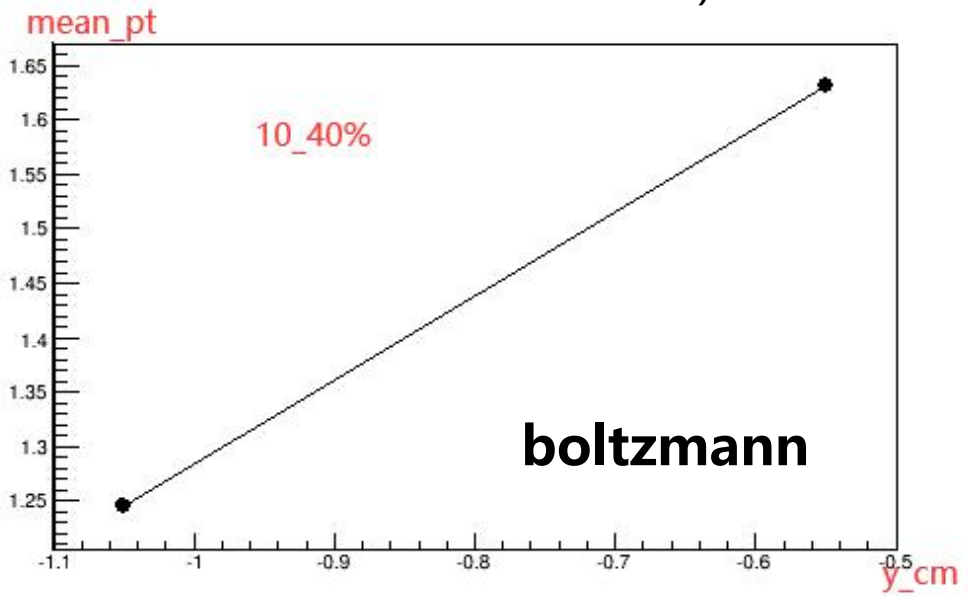
$\langle p_T \rangle = \int p_T \cdot \frac{d^2N}{dp_T dy} dp_T / \int \frac{d^2N}{dp_T dy} dp_T$ (from fitting function, $0<p_T<10$ GeV/c)

- denominator:
  value: the integral from 0 to 10 of the fit function in slides 2
  function style:
  boltzmanntimespt: [1]*x*sqrt([2]*[2]+x*x)*exp(-sqrt([2]*[2]+x*x)/[0])



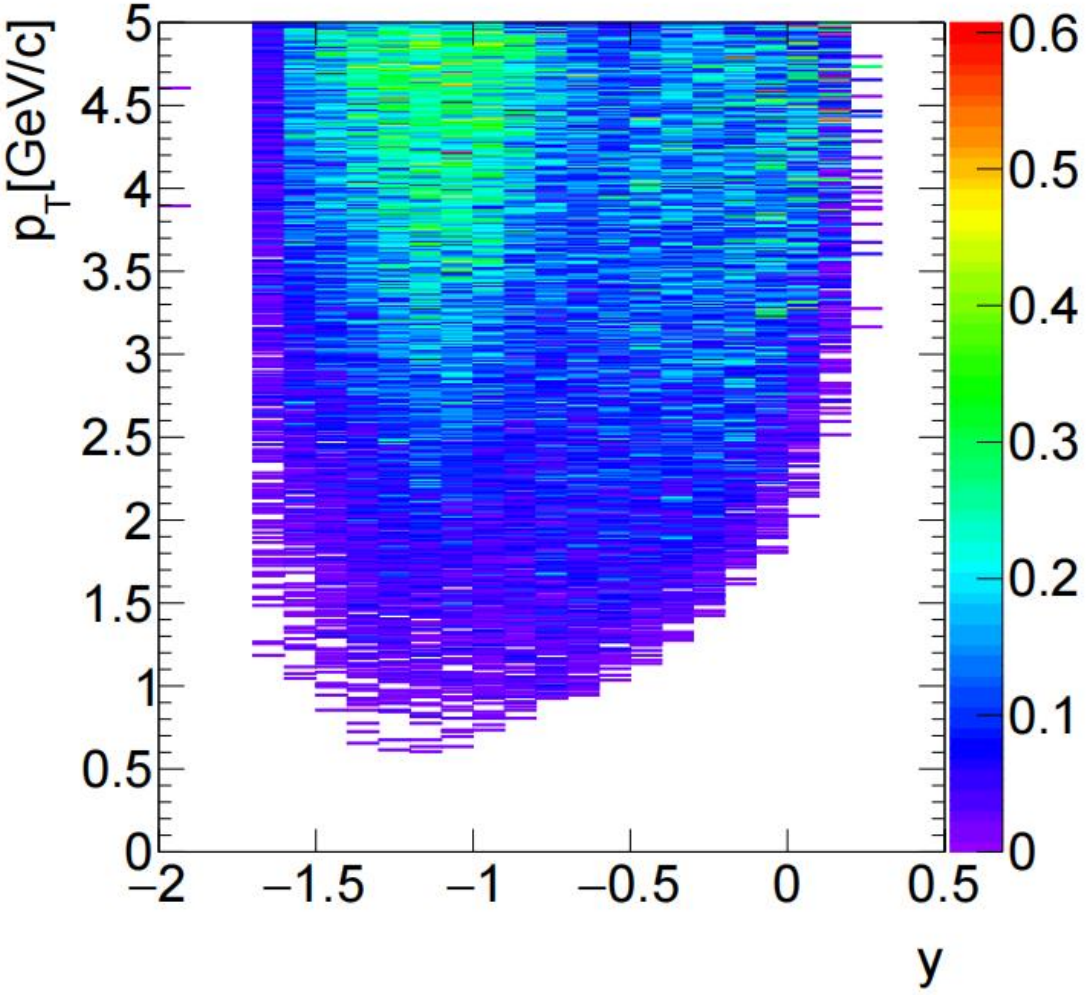
- numerator:
  value: the integral from 0 to 10 of a new function(using the same parameters as function of denominator).
  function style:
  ptboltzmanntimespt: [1]*x*x*sqrt([2]*[2]+x*x)*exp(-sqrt([2]*[2]+x*x)/[0])
  set function parameters the same as the fit function in slides 2.

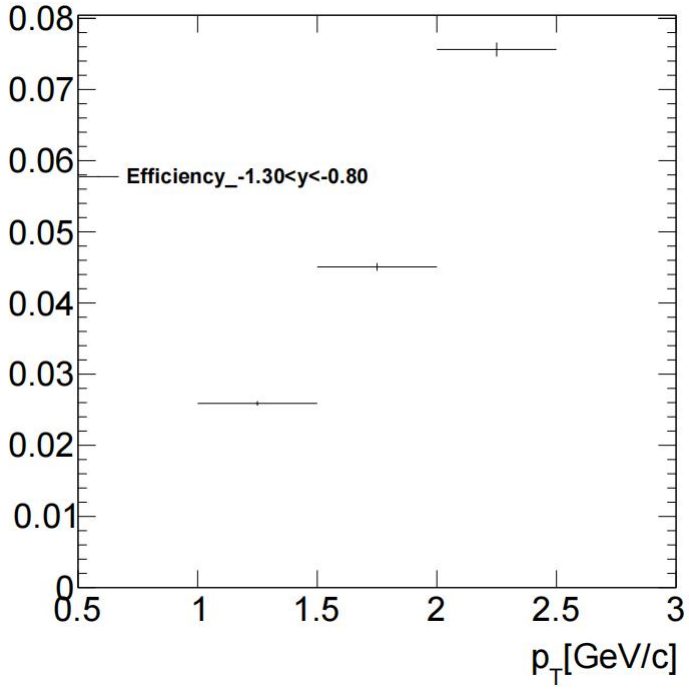
▪ethods	dNdy(0-10%,-1.3~-0.8)	dNdy(10-40%,-1.8~-0.8)
▪eantpt (boltz▪ann)	1.11627	1.24433
▪eantpt (▪texptrap)	1.11533	1.24151
▪eantpt (ptgaussexp)	0.936628	0.990099
▪eantpt (pt3exptrap)	1.05859	1.16051
▪ethods	dNdy(0-10%,-0.8~-0.3)	dNdy(10-40%,-0.8~-0.3)
▪eantpt (boltz▪ann)	1.38075	1.63206
▪eantpt (▪texptrap)	1.37905	1.63433
▪eantpt (ptgaussexp)	1.16558	1.51828
▪eantpt (pt3exptrap)	1.31476	1.58348

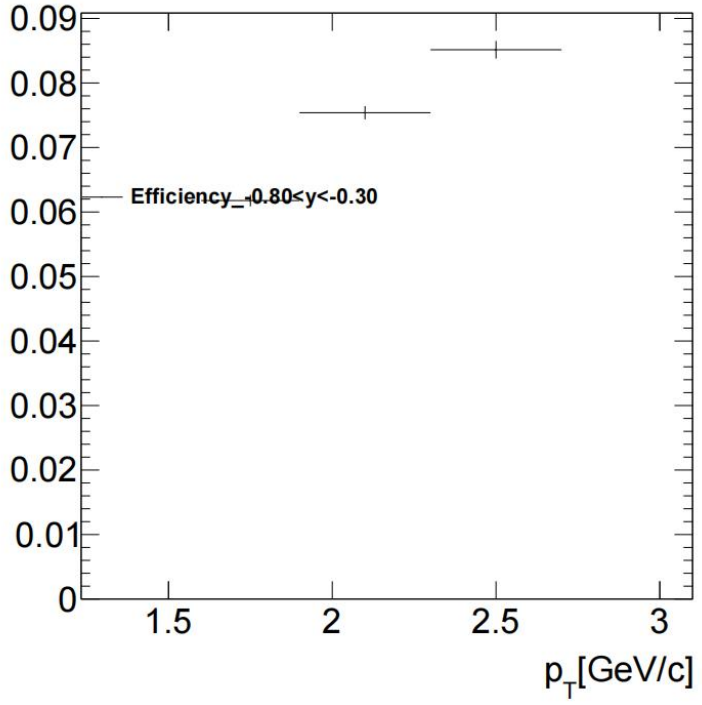


- Cen:0-10%.

Efficiency

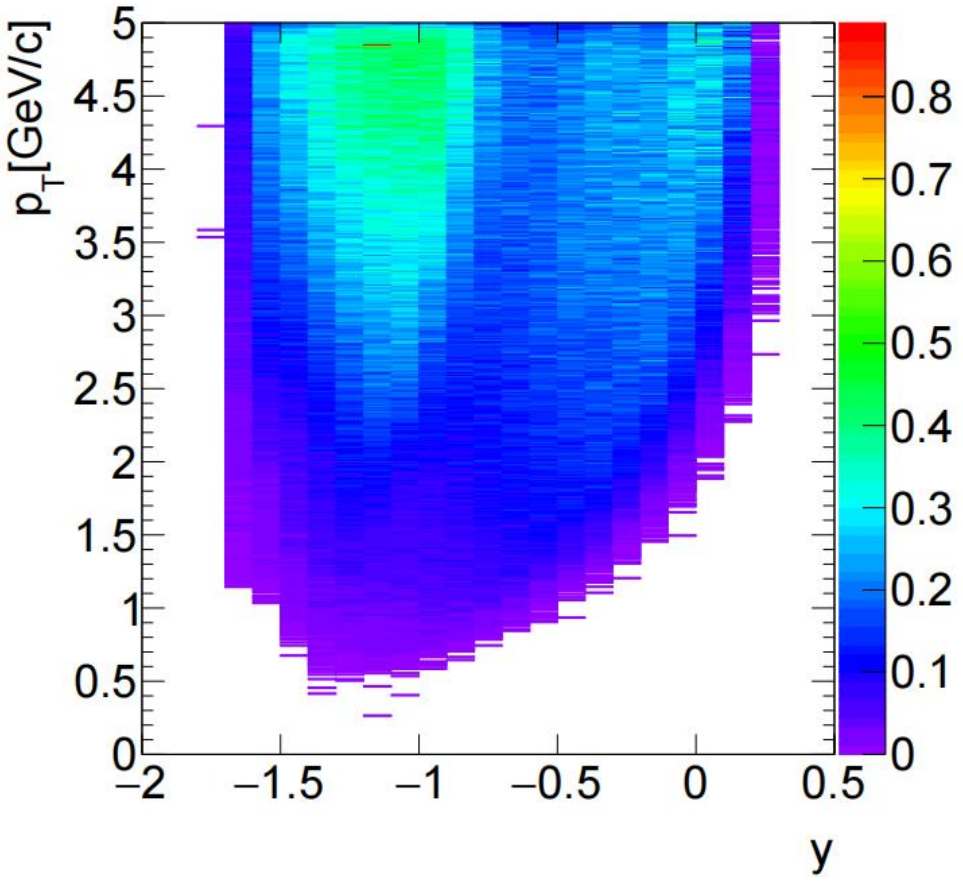


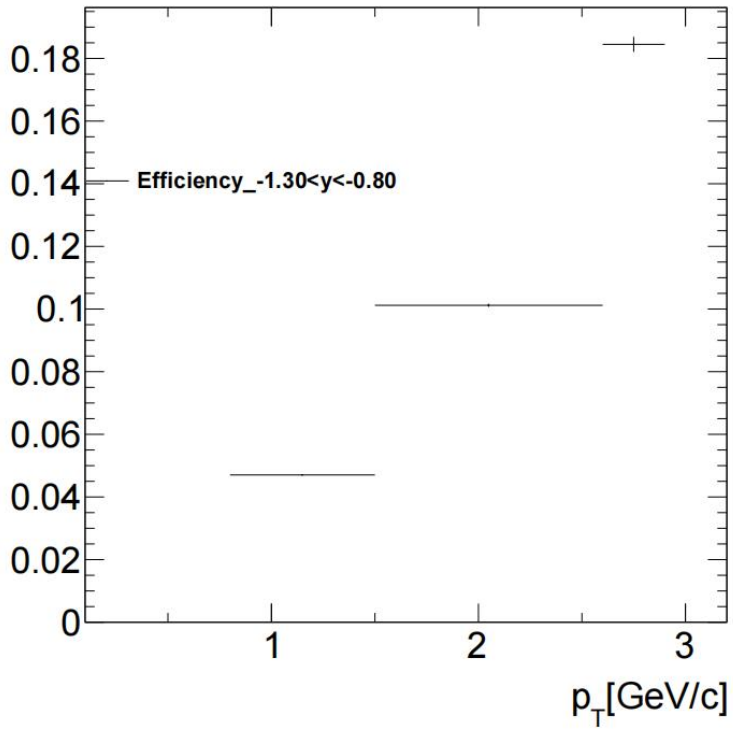


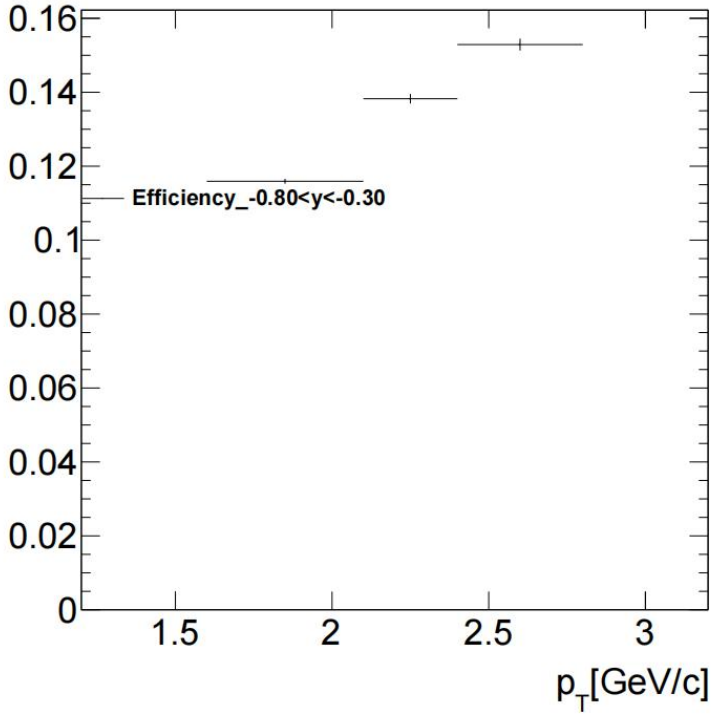


- Cen:10-40%.

Efficiency





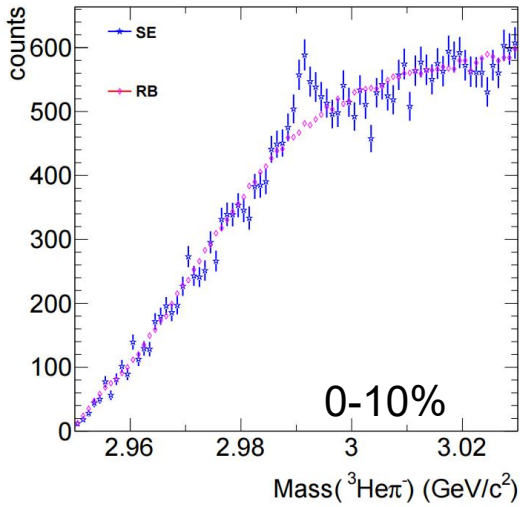


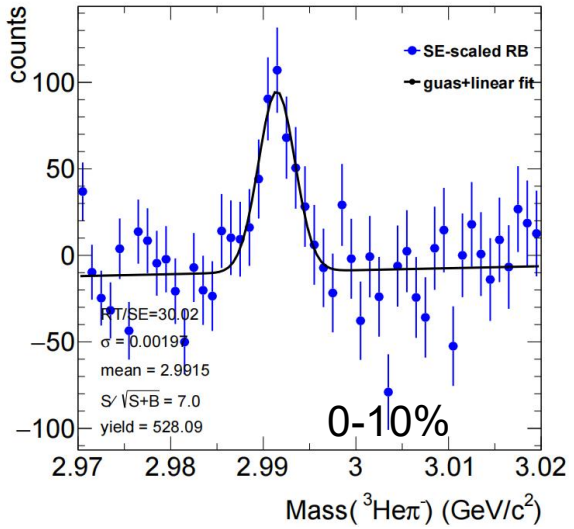
Signal and acceptance

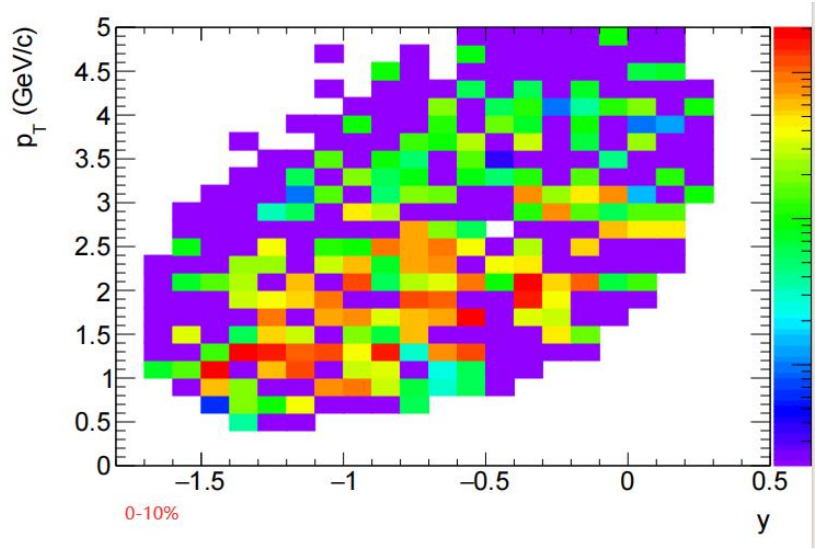
- bin by bin counting

0-10%
l >1, ldl>6
chi2topo<5,
chi2ndf<2.2
chi2prim_pi>5
chi2prim_he>0

pt_pi>0.15

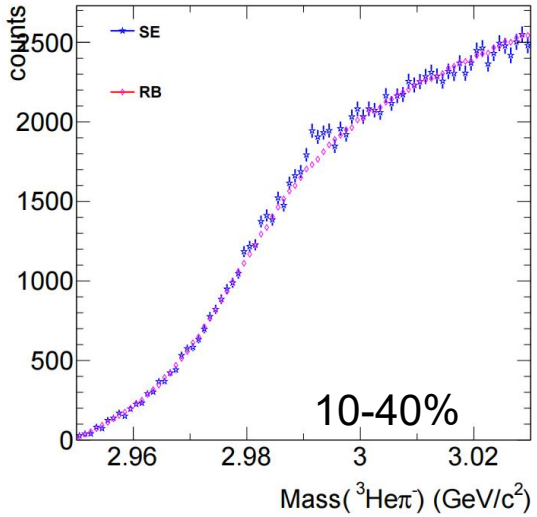


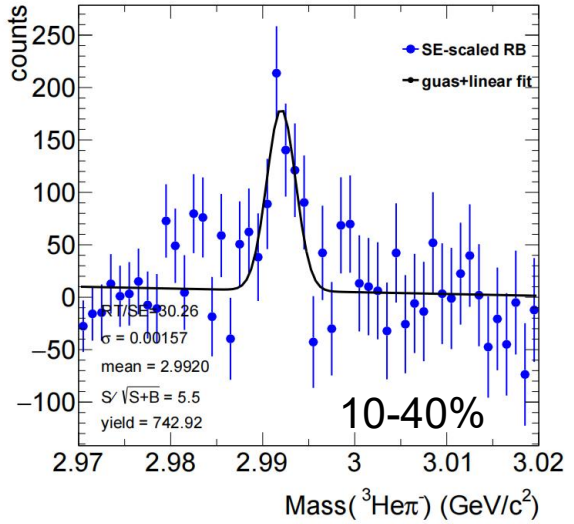


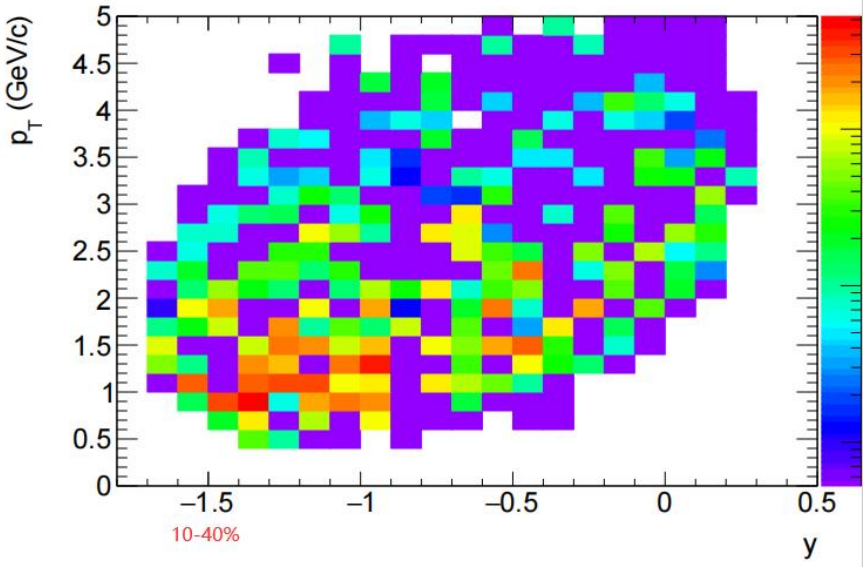


0-40%
l >1, ldl>1
chi2topo<5,
chi2ndf<4
chi2prim_pi>11
chi2prim_he>0

pt_pi>0.15



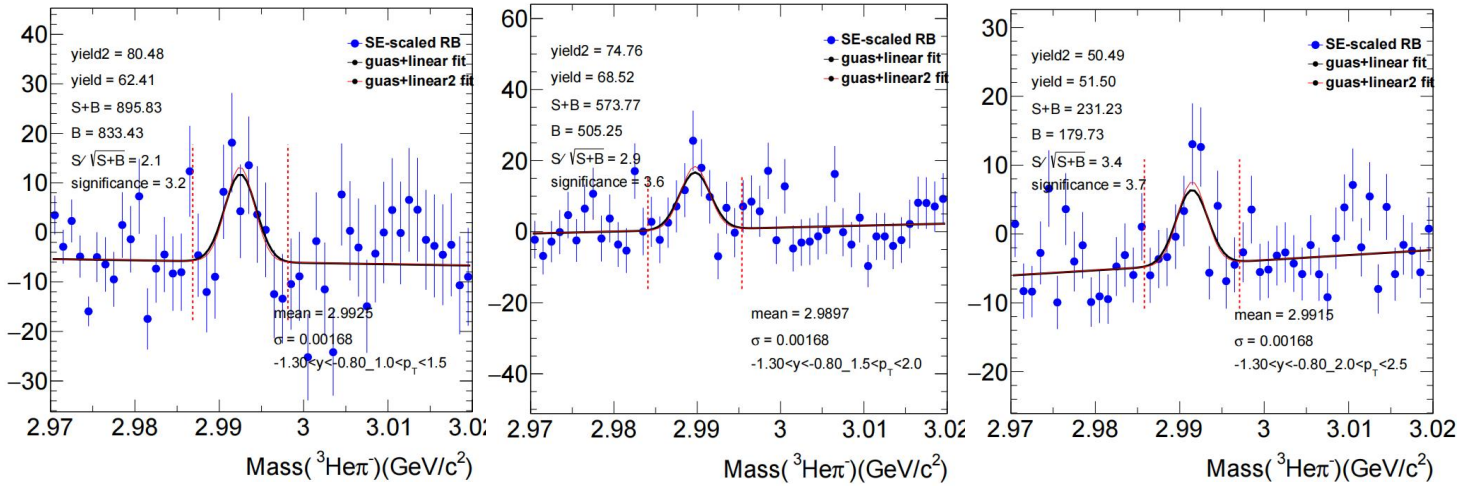


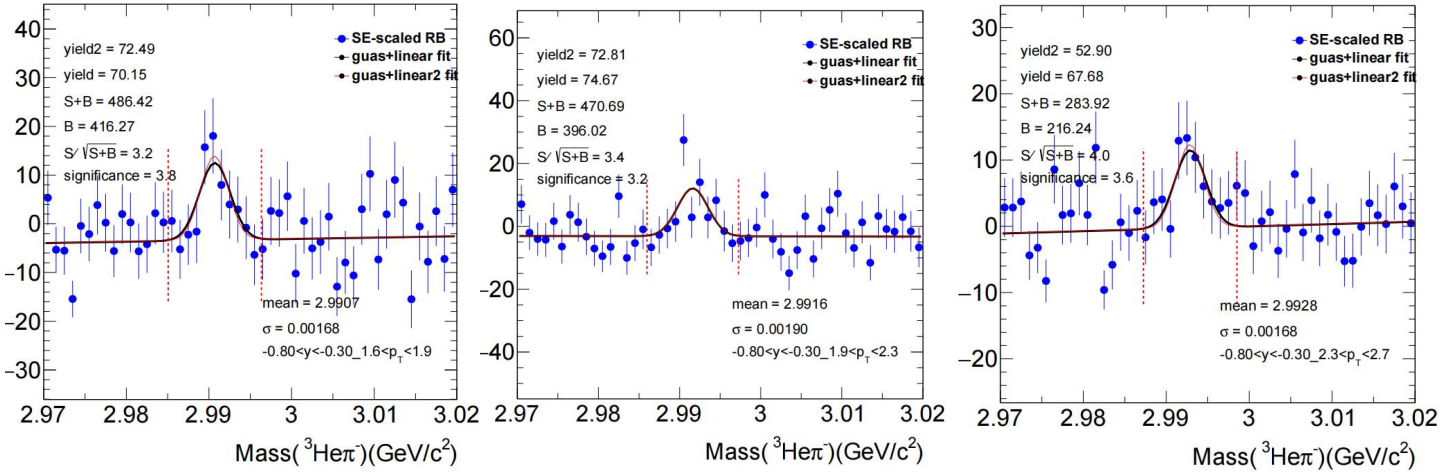


Signal with different pt and y ranges

- Cen:0-10%.
- the mass window in each y_pt bin :fitmean-3*fitsigma<particlemass<fitmean+3*fitsigma(bin by bin counting)
- fit function:gaus+line

-1.3<y<-0.8





-0.8<y<-0.3

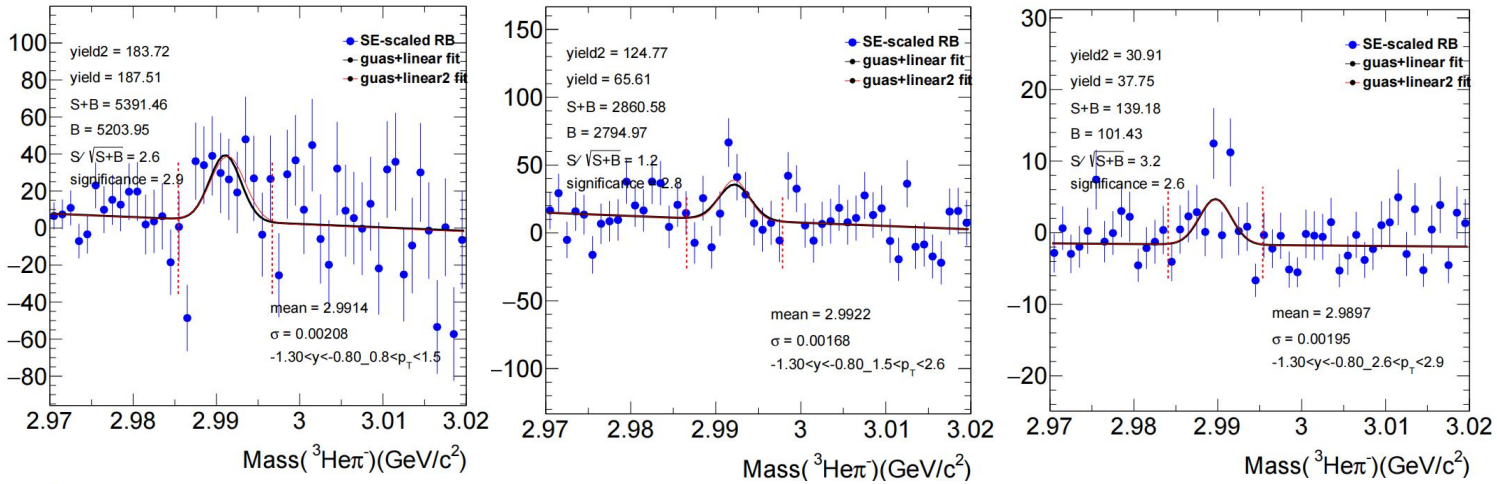
- integral method(red line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma range(guided by 0-40%) (sigma-0.0002,sigma+0.0002)

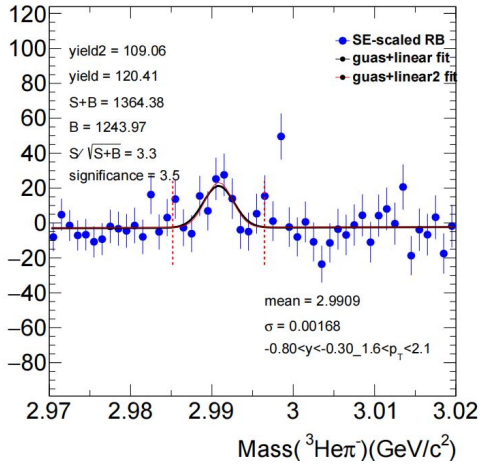
- bin by bin counting(black line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma(guided by 0-40%)

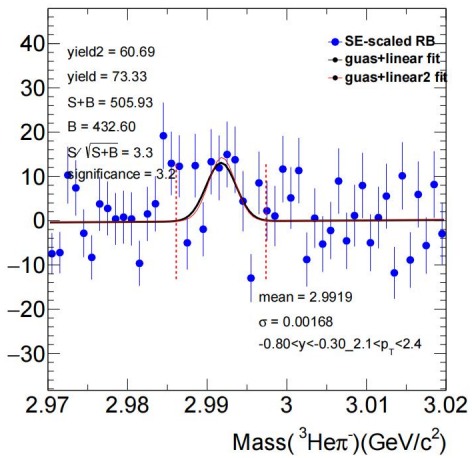
Signal with different pt and y ranges

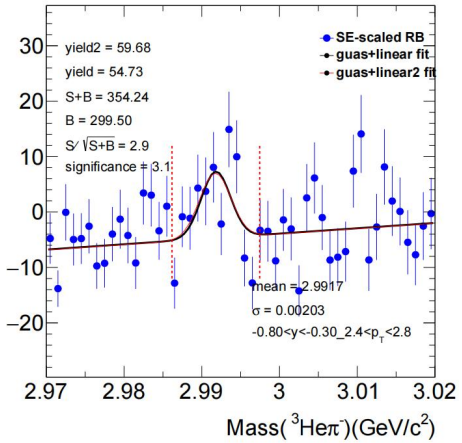
- Cen:10-40%.
- the mass window in each y_pt bin :fitmean-3*fitsigma<particlemass<fitmean+3*fitsigma(bin by bin counting)
- fit function:gaus+line

-1.3<y<-0.8









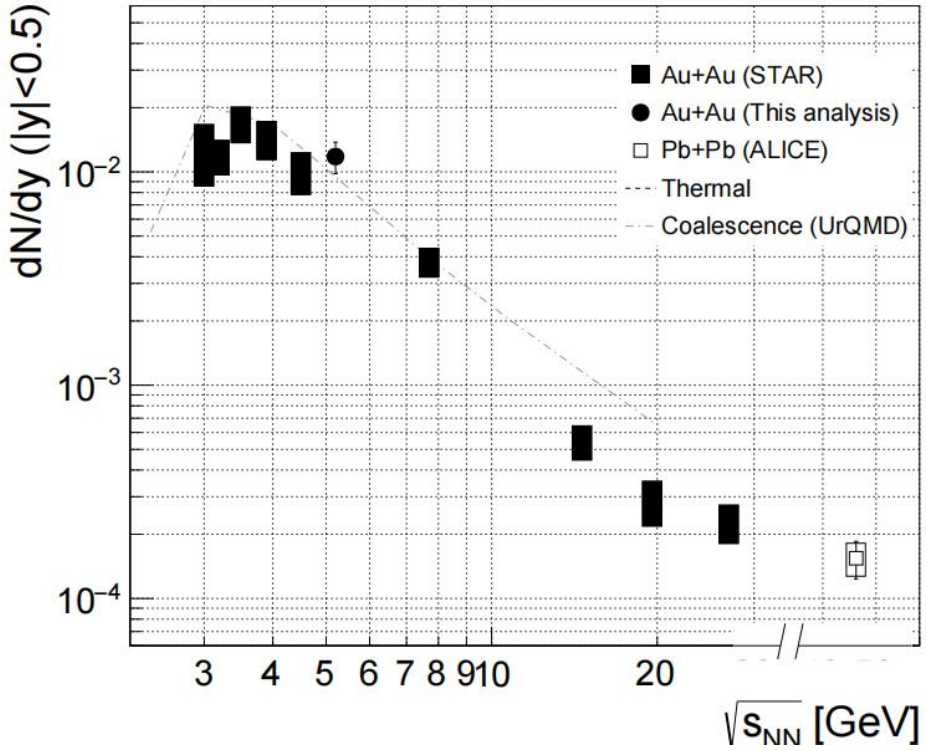
-0.8<y<-0.3

- integral method(red line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma range(guided by 0-40%) (sigma-0.0002,sigma+0.0002)

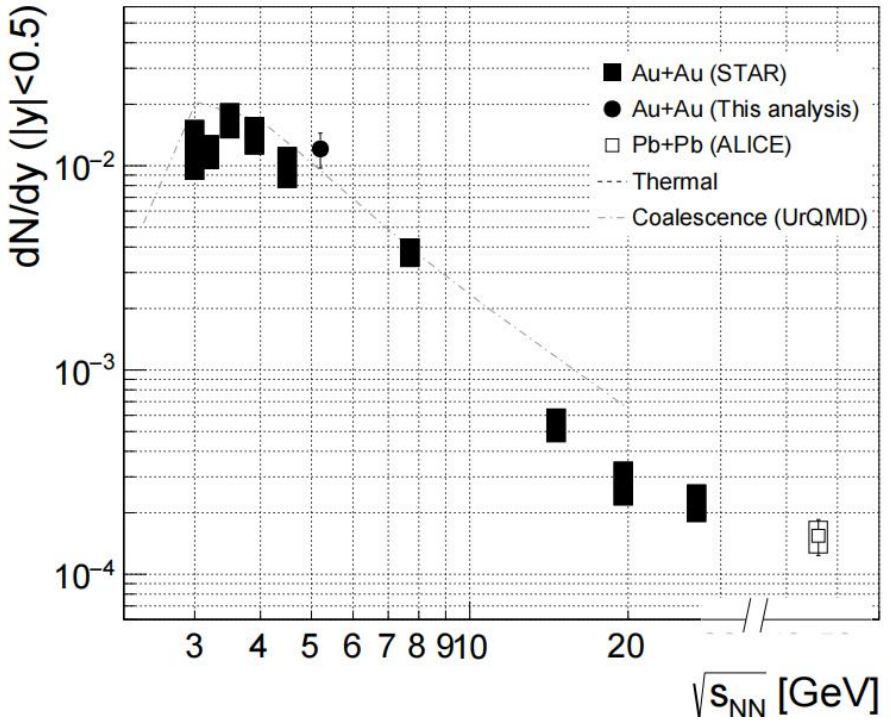
- bin by bin counting(black line)
  - Fix fitmean range(guided by 0-40%) (mean-sigma,mean+sigma)
  - Fix fitsigma(guided by 0-40%)

P_T spectra

- Cen:0-10%.
- yield:integral method (fit function's first parameter)



scaled (y:-0.8~-0.3)



scaled (y:-0.7~-0.2)

P_T spectra

- Cen:0-10%.
- yield:integral method (fit function's first parameter)